

SKI - MOUNTAINEERS'

NOTEBOOK

THE MOUNTAINEERS, INC.

SEATTLE, WASH.

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THE MOUNTAINEERS, INC.

1942

*Actually written in 1941, I think!
. 1st year of the ski mountaineering
course.*

THE MOUNTAINEERS , INC.
Seattle, Wash.

SKI MOUNTAINEERING COURSE---REQUIREMENTS AND PROGRAM

PURPOSE OF COURSE

To increase mountaineering knowledge and improve skiing skill so as to make possible the safe penetration of remote areas and the ascent of high peaks on skis, and to increase the joy of the ski-mountaineer in his sport because of greater skill and confidence.

LIMITATION OF COURSE

Persons wishing to become Ski-Mountaineers must necessarily learn how to ski first. Because this course will not teach the elements of skiing technique, it will be necessary for beginners to learn to ski elsewhere. However, the improvement of and correction of technique is a part of this course.

REQUIREMENTS FOR ENROLLING IN THE COURSE

Membership in the Mountaineers.

- Payment of 25¢ to cover cost of notebook.

Be able to pass Class 4 ski touring test---Four successive uphill traverses and uphill kick turns, and four successive downhill traverse and downhill kick turns on a 30 degree slope (or steeper) without falling.

REQUIREMENTS FOR GRADUATING FROM THE COURSE

Attend 5 out of the 7 classroom sessions.

Pass the final examination.

Attend 3 out of 4 practice trips, including the overnight camping trip and the roped skiing practice.

Pass Class 3 ski touring test--4 successive linked downhill turns on a 30 degree slope (or steeper) without falling.

Complete two extended ski tours, one of which involves roped glacier skiing and one of which requires snow camping.

PROGRAM OF COURSE

Session 1, Clubroom	Elementary Principles	Tues.	Nov. 4, 1941
1st practice trip	Improvement of ski technique	Sun.	Nov. 16
Session 2, Clubroom	Snowcraft and Waxing	Tues.	Nov. 18
Session 3, Clubroom	Avalanches	Tues.	Nov. 25
Session 4, Clubroom	Route Finding	Tues.	Dec. 9
2nd practice trip	Improvement of ski technique	Sun.	Dec. 14
Session 5, Clubroom	Snow Camping	Tues.	Dec. 16
Session 6, Clubroom	Emergencies	Tues.	Jan. 6
3rd practice trip	Camping, Equipment, Compass, Map	Jan.	10-11
Session 7, Clubroom	Glacier Skiing	Tues.	Jan. 20
Session 8, Clubroom	Final Examination	Tues.	Jan. 27
4th practice trip	Roped Skiing, Crevasse Rescue	Sun.	Feb. 1

ACKNOWLEDGEMENT OF THANKS TO THE CLIMBERS COURSE

For the successful example set during the past seven years

For the loan of much organized mountaineering material

NECESSITY OF REPETITION OF SOLE CLIMBERS COURSE MATERIAL

To make the ski-mountaineering course complete, since many will take it who have not previously had the climber's course.

To emphasize the application of general mountaineering knowledge to ski mountaineering rather than foot mountaineering.

SUGGESTION

To members enrolled in this course who have not had the Climbers Course, it is recommended that you enroll at the first opportunity to further your knowledge of mountaineering.

COMMITTEE

Mountaineer members responsible for organizing this course are:
Fred Ball, Lyman Boyer, Joe Buswell, Tom Campbell, Harry Cameron,
Ann Cederquist, Mary Kelly, Walt Little, Ted Murray, Jud Nelson,
Stan Newell, Stan Savage, Roland Sherman, Burpee Stevens, Walt
Varney, Jim Wasson, Art Winder.

CLUBROOM SESSIONS

Meetings will start at 8 p.m. Sharp. Notes will be handed out and discussed by a lecturer for about 3/4 hour. Thereafter, a set of practice problems will be turned over to each enrollee, for answering and discussing within the class period. These papers will not be graded, but are for the purpose of illustrating the points brought out in the outline notes. At the end of the period, correct answers will be given to all the problems. Problem sets will be handed in at end of period for the purpose of taking attendance. They will be returned at the next session.

NOTEBOOK You will need a loose leaf note book in which to keep notes, and also a pencil at each meeting.

PRACTICE TRIPS

Detailed information on the practice trips will be announced at the clubroom session just prior to the week end of the practice trip.

GRADUATION PARTY

Graduation ceremonies and awards will take place sometime after June 30, in order to allow all concerned to take part in the required glacier tour.

FINAL WARNING TO HIM WHO WOULD ENTER

This being the first time that this course has been attempted in its present form, you must expect that there will be rough spots in it and that the program may be changed at a moment's notice. The committee asks your tolerance of the unintended blunders which may occur, and requests your suggestions for the improvement of the course for next year.

The Mountaineers, Inc.
Seattle, Wash.

ELEMENTARY PRINCIPLES OF SKI-MOUNTAINEERING

DEFINITION:

Ski-Mountaineering is the ascent of snow covered peaks or the penetration of snow covered areas partially or wholly by means of skis.

REQUIRED SKILL AND KNOWLEDGE FOR SAFE SKI-MOUNTAINEERING

Mountaineering knowledge of weather, natural dangers, camping, methods of meeting emergencies, and safety techniques.

Special knowledge of snowcraft at all seasons.

Skill in the use of skis.

Common sense.

Physical condition and some ambition--ski-mountaineering is not for the lazy.

SKI-MOUNTAINEERING IS FUN

For mountain-lovers, it makes mountaineering an all-year-round recreation.

It makes accessible the beauty of snow covered landscapes.

It combines the fascinating sport of mountaineering with the equally fascinating sport of skiing.

The use of skis converts tiresome footslogging across soft snowfields into easy ascents and thrilling descents.

The real urge to go ski-mountaineering--just like the urge to go "boot" mountaineering--is indefinable, but positive. Probably no one who hasn't tried it will ever know how much fun he is missing.

SUBJECT OF THIS LESSON

This lesson will explain the general principles of ski-mountaineering and the amount of skiing skill which the mountaineer should have.

SAFETY

Safety in ski-mountaineering is of prime importance, since an accident in a remote area can quickly lead to great discomfort, perhaps tragedy. The following rules must be observed:

1. Never go alone.
2. Always leave word with some one as to where you are going.
3. Carry proper equipment.
4. Ski always in control--recklessness cannot be tolerated.
5. Do not attempt trips above your capabilities.
6. Avoid exhaustion--accidents usually happen to tired skiers.
7. Always follow your leader's instructions.
8. Watch for and avoid thinly covered rocks.
9. Don't ski with anything in your mouth

PHYSICAL CONDITION

Good physical condition is essential for ski-mountaineering.

1. It leads to considerably more enjoyment.
2. An exhausted skier is easily injured.

3. An exhausted skier cannot do his share of trail breaking.
4. An exhausted skier becomes a burden on the rest of the party, who must necessarily take care of him.

Methods of building up the necessary wind and muscle.

1. Best way is to start with easy trips, either mountain-climbing or skiing, gradually building up to tougher ones. Such trips, taken only once a week for a several-months-period, will be all the conditioning necessary.
2. Handball and basketball and other gymnasium games will help but do not build up endurance.
3. Lots of good food and plenty of sleep before a tough trip will markedly increase stamina. Don't start on a tough trip unless you know that you can make it.

MANNERS AND GOOD SPORTSMANSHIP

Ski-mountaineering is always done in the company of others. Manners and good sportsmanship on the part of all the members are necessities for a successful party. The rule for good manners is to think of others first--let your actions be guided by a spirit of consideration for others. Some suggestions:

1. Don't complain--about the weather or the grub or the leader or anything else except in a humorous vein.
2. Be on time.
3. Bring sufficient equipment of your own.
4. Have your equipment in good repair--you have no business delaying the party while you fix it.
5. Yelling "track" does not entitle you to the right of way.
6. Do not ski recklessly--if you get injured, you will seriously interfere with the enjoyment of the people who pack you out.
7. Help your driver to load equipment on the car.
8. Do not ski off downhill far ahead of your party--it's very unsociable, and you may be needed to help in case of accident.
9. Do your share of trail-breaking.
10. Don't walk on the skis of the man ahead.

ENERGY--LEVEL AND UPHILL

Ski-mountaineering requires maximum economy in the use of energy. Nearly every healthy person can develop enough energy for long trips, if it is economically used.

The pace for long-distance travel must be slow enough to avoid a pounding heart or gasping breath; the pace for shorter distances may be faster.

Rhythmic, steady motion is the key to progress.

Breathing should be deep and steady.

Footsteps should keep time with the breathing, especially at high altitudes.

Relax all your muscles as much as possible.

Use the rest-step.

Wherever possible, slide your skis instead of lifting them.

When you start a trip, warm up slowly by adopting a slow pace and wearing extra clothes.

After 15 minutes, stop to remove extra clothing and adjust packs.

On the trail stop for short "breathers" of about 2 minutes every half hour.

On long rests take off your pack and put on extra clothing.
On level going, use long gliding steps, keep skis sliding.
On uphill going, use shorter steps, don't try long glides.
Remember that if you are gasping for breath, you are going too fast.

NECESSARY SKI TECHNIQUE FOR LEVEL AND UPHILL

Ability to walk on skis with easy, rhythmic pace.
Ability to do both uphill and downhill kick turns on slopes of thirty degrees or steeper.

DESIRABLE SKI TECHNIQUE--LEVEL

Ability to do one or more of the cross-country racing steps for easy going on the level. The secret is to properly synchronize the steps with light pushes on the poles.

NECESSARY CLIMBING DEVICES

To make the skis go readily uphill, proper wax, canvas climbers, (or so-called sox), sealskins or mohair "skins" must be used.

Proper waxing is very satisfactory and will both climb and slide.

Canvas climbing sox are practical, being cheap and easy to put on, but on steep side slopes the rear edges will not hold, since the sox cover the edges of the skis.

Sealskins or mohair "skins" are excellent climbers and will even slide slowly downhill, but are expensive.

Advantages of proper waxing over climbers:

1. Lighter weight.
2. Can both slide and climb, which is a great advantage in rolling country.
3. The edges hold better on steep side hills.
4. Climbers require time to put on and take off.
5. Climbers, when removed, are wet or icy and uncomfortable to carry.
6. On the level, climbers must be walked; skis will slide.
7. Climbers and wax have equal speed uphill.

Advantages of climbers over waxing:

1. Skis can be waxed for maximum speed downhill.
2. Guesswork as to which wax to use can be eliminated.
3. Climbers are better on varying snow.
4. Climbers eliminate fussing with wax while on tour.

SKI CLIMBING TACTICS--LEVEL AND UPHILL

Don't climb too steeply; extra pushing on poles and backward slips use up extra energy. Climb on the steepest grade on which climbing seems easy; this is usually about 20 feet vertically for 100 feet of horizontal distance, or about on an 11 degree slope. Thus, to climb 1,000 feet, the skier will have to travel 5,000 feet or about one mile horizontally, regardless of which route he chooses.

To save energy, use as few kick turns as possible. Long traverses on steep slopes are fatiguing because one foot is higher than the other; under these conditions traverses should be about 500 feet long.

Side-stepping is used for steep, narrow slopes; uses much energy.

Herringboning is used for steep, short, narrow slopes; it uses the maximum amount of energy.

Half-sidestepping is used on traverses where it is necessary to gain altitude rapidly. Uses more energy than traversing, less than sidestepping.

Poles should be used mostly for pushing, only incidentally for keeping balance.

Keep the snow rings of the poles back of the feet and close to the skis to arrest backward slips.

ENERGY--DOWNHILL

Maximum economy in use of energy is important.

Best method is to keep as relaxed as possible--tenseness is very tiring.

Don't go too long before stopping to rest.

Get your breath back before starting again.

Don't forget to breathe while you ski downhill; deliberately take a few deep breaths before starting and keep up a steady rhythm.

If you begin gasping for breath, stop and rest.

STRAIGHT RUNNING AND TRAVERSING ON SKIS

This is used more than any other technique---skill is essential.

On hard snow, skis should be 6-12 inches apart, one foot 0 to 12 inches ahead of the other. Weight evenly on both skis.

On soft, deep snow, keep skis together, with thighs pressed against each other for bracing effect. One foot should be 12-18 inches ahead of the other. Weight mostly on rear foot.

Transitions from steep to flat slopes are difficult. Sink gradually down into a crouch as you travel from the beginning to the end. Keep the knees pressed well forward.

When running straight downhill, keep skis very slightly on the inside edges.

Traversing across the face of a steep hill is difficult to do correctly. Skis should be about 6-12 inches apart, upper foot 6-12 inches ahead, weight mostly on lower ski. Skis should be transversely about level, not edged sharply into the hill.

Controlled side-slipping is very useful. Use the traversing position, side slip by flattening the skis to the slope, control the speed with the edges. Keep the weight on the lower ski.

When running from slow snow into fast snow, lean forward and be ready for sudden acceleration.

Tell fast snow from slow snow by color, texture, location in sun or shade.

USEFUL SKIING TURNS FOR SKI MOUNTAINEERING--DOWNHILL

Kick-turn is the only absolutely necessary turn, and can be used anywhere in any kind of snow, but is too slow for long trips.

Stem turn is the most useful turn, and mastery of it is really essential for long trips. Can be used in any snow except breakable crust.

Stem Christiana can be used in same places as stem turn, is a faster turn and more fun. This one should be learned.

Step turn is useful at slow speeds and on flat slopes, and can be used in any snow.

The telemark is useful under the limited conditions of deep, heavy snow on slopes less than 25 degrees.

Tempo turn, or parallel Christiana is the most fun in perfect snow, but is otherwise not very practical.

USEFUL SKIING TURNS FOR SKI MOUNTAINEERING--DOWNHILL (CONTINUED)

The Open Christiana is not recommended, as the "scissors" position is dangerous.

In breakable crust, the only safe turns are the kick turn and the jump turn.

For ski mountaineering, turns must usually be executed in untracked snow, which is more difficult than the practice hill.

The technique of turning will be taught only incidentally in this course. Best way to learn is to take lessons from a competent instructor. Complete descriptions of all turns may be found in many textbooks in the Mountaineer library.

Best way to improve your turning technique, after you have mastered the essentials, is to alternate between practice hill work, and touring in untracked snow.

MANAGEMENT OF POLES--DOWNHILL

Never put your ski poles in front of you when running. They may catch and injure you. The only exception is for jump-turns, stick-christianas, or gelandersprungs.

Let your poles drag comfortably behind you.

Poles should not be used to help keep the balance, except possibly when you are moving very slowly.

Remove the loops of the poles from your wrists to save the nasty spill which comes when the snow ring catches on a stub, and possibly to save a broken wrist.

CONTROLLED FALLS

This is meant an intentional fall for the purpose of making a sudden emergency stop, or to stop when out of control, or to control speed when no other method is possible.

Certain principles about falls should be learned to prevent injury.

Keep legs and skis pressed tightly together. The strength in two legs to resist a twist is more than twice as great as one leg.

Fall on the seat throwing yourself backwards and slightly to one side of the skis, keeping the knees and hands out of the snow.

Knees should be kept slightly bent.

Manage the skis so that the tips do not bury themselves in the snow.

Fling your poles sidewise and back of you as you fall.

Note: it's no use buttoning your pockets after they are full of snow.

UNCONTROLLED FALLS--HOW TO MINIMIZE THE DANGER OF INJURY

Some unintentional spills are inevitable, but the danger can be minimized.

The critical moment comes at the instant when you know that you cannot save yourself from a spill. Think and act quickly, as follows;

Try to fall in the same position as in the controlled fall.

Try to jerk the skis out of soft snow, by giving a quick jerk.

The danger of injury lies in the skis getting stuck in the snow while you keep going.

If possible, bring your legs together with the knees bent.

Fling your poles out sidewise.

Don't try to arrest your fall with your hand and arms.

If you are headed for a "header" give a slight jump to pull your skis out of the snow, and try to convert the header into a somesault.

TECHNIQUE OF GETTING UP FROM FALLS

Much energy is used up by beginners in struggling to rise from a spill by ordinary means.

If on a side hill, roll over on your back, and get the skis below you and normal to the slope. Plant both of your ski poles in the hill slightly above you, and with their aid stand up on your skis.

If on the flat, sit up and plant your ski poles in the snow, one on either side of you, then lift yourself as though you were chinning yourself.

If you fall headfirst into a hole, holler for help!

ANGLES OF SLOPES

Because the steepness of slopes causes vast argument, here are some examples:

10 degree slope--a little flatter than the rate a skiers climb.

20 degree slope--ideal slope for easy skiing.

30 degree slope--pretty steep, like the upper part of the "lane" at the Meany ski Hut.

35 degree slope--very steep, like the steepest part of "Panorama Point" at Paradise Valley.

45 degree slope--snow will rarely lie any steeper than this. On top looking down, it seems like a vertical wall.

SKIING EQUIPMENT

The same equipment used for ordinary skiing is usually quite satisfactory.

Skis should be as light as possible, but with metal edges.

Poles should not be too light, as there is danger of breaking them.

Boots should be of very good quality, as water tight as possible. If your boots leak take extra socks.

Bindings should be well fitting to boots; nearly any type will do; Downpull attachment is recommended.

For spring conditions where considerable hiking must be done to reach the snow, fit your bindings to a pair of nailed climbing boots, and get a shorter pair of skis.

Drill a hole in the tips of the skis, and carry a string by which to tow them.

Equip your bindings with an ankle strap, so that you will not have to chase ski downhill if binding comes loose.

Packsack should be of the Bergan type, of medium or large size. This is the only type of pack that will not roll and throw the skier off balance. A small pack is not recommended, since at best it only saves a pound of weight, and will not carry the essential equipment.

Climbers or climbing wax are always needed.

PROTECTION AGAINST EXPOSURE

Standard woolen ski pants are excellent for ski-mountaineering.

Parka should come below hips, have a large hood to cover most of face, and should be made of wool. Cotton, even if allegedly "waterproofed" will eventually soak through, then gets cold. Wool gets wet but stays warmer. Parkas made of raincoat material will keep the rain out, but cause most people to perspire excessively.

Parka and several light sweaters give more warmth for the weight than will a heavy coat or mackintosh.

Don't dress so warmly that you will perspire.

PROTECTION AGAINST EXPOSURE (CONTINUED)

Take extra clothes even in sweltering weather. You will need them if you should have to stay out overnight, or in case of sudden storm.

Don't go skiing with bare legs unless you are absolutely certain that you can stand normal exposure to wind, sun, cold or ice, but even so take along something to cover up the legs in case exposure turns sever.

Take two pairs of fingerless mittens, leather or canvas for protection, wool inside for warmth.

Take change of socks on every overnight trip.

Always take ski cap or stocking cap for protection of head and ears.

Remember that warmth is energy. Dress properly so as to retain it.

Leave a complete change of clothes in the car, so that when you return wet from rain or sweat, you can change immediately.

Always take sunburn paint in the spring.

Sun glasses are necessary to prevent snowblindness. Recommended type are of celluloid with side shields, well vented in front to prevent fogging.

ELEMENTARY PRINCIPLES --- PROBLEMS

1. Going alone for a 3 mile trip is safe, even if there are no people about, and you haven't told anyone. True or False
2. Going alone to the top of Panorama Point at Paradise Valley is safe. True or False
3. It's safe to go alone to Camp Muir. True or False
4. It's safe to approach a blind edge at high speed, since 19 times out of 20, what looks like a blind edge will merely be the rounded top of a hill. True or False
5. It's dangerous to ski at high speeds when there is less than two feet of snow on the ground. True or False
6. The more tired you become, the better you will ski, because of all the extra practice. True or False
7. Skiing with a pipe in your mouth is good mountaineering. T or F
8. Never leave word with anyone about where you are going. Let 'em guess, as it's none of their business. True or False
9. You should go on some shorter ski trips before tackling the longer ones. True or False
10. Always go as far as you can on the first day out, as the more you exhaust yourself, the sooner you will get into good physical condition. True or False
11. It is discourteous to be late for the start of a trip or the beginning of a meeting. True or False
12. Always criticize your leader if you don't like the way things are going. He's there to take it! True or False
13. If you don't believe the leader's instructions are correct, you don't have to follow them. True or False
14. Given the following types of pace over a slightly uphill terrain: (a) Extremely rapid pace with frequent rests; (b) Slow, steady pace with no rests and easy breathing; (c) Faster pace with no rests but heavy breathing.
 Which will be the fastest for one hour? _____
 Which will be the fastest over a whole day? _____
15. Your bindings should be fairly loose going uphill and the downhill pull should be taken off. True or False
16. Given the following devices for going uphill: (A) wax (B) canvas sock climbers (C) sealskins; which would you choose for each of the following routes:
 a. A long, open sidehill, always uphill _____
 b. An up-and-down route through forested country _____
 c. A route which can be climbed by means of a chair lift _____
 d. Continuous uphill grade; varying snow conditions _____
 e. Mostly uphill, some downhill, some sidehill, uniform snow _____
 f. Continuous uphill grade; uniform snow, no sidehill _____
17. Davy Jones leads a party to the upper edge of a steep, narrow gully 300 feet high, filled with deep heavy snow. He tries to avalanche the snow out of the gully by jumping on it, but the snow is too securely anchored. His party is composed of medium skiers, and the time is late afternoon, so there is no time to waste. How does he advise his party to travel in order to get to the bottom as soon as possible.
 a. Take 'em off and walk.
 b. Side slip all the way to the bottom.
 c. Run it straight with controlled falls where needed.
 d. Use parachutes.
 e. Use short traverses and kick turns.
 f. Take it straight without falling.

18. When side slipping down a slope, the weight is mostly on the upper foot. True or False
19. When straight running in deep snow, the weight is mostly on the forward foot. True or False
20. The Herringbone method of getting uphill uses less energy than the sidestep. True or False
21. Sadie Schmaltz is traversing along a steep slope on the shady side of a hill, and is about to break out of the shadow onto a sunny slope. Should she
- Lean forward, ready for a sudden acceleration.
 - Pay no attention, just keep on going.
 - Lean backward, ready for a sudden check.
 - First stoop, then walk across the doubtful area.
22. Artie McHosenozzle is just learning how to ski, and insists that the proper way to ski in deep snow is with his skis about 3 feet apart, neither ahead of the other. Somehow he falls a lot. Would you advise him to
- Spread his feet even farther apart.
 - Get longer skis.
 - Get shorter skis.
 - Put skis right together, one foot 12 inches ahead.
 - Put skis right together, neither foot ahead.
 - Get skis with a longer upturn.
23. You wish to climb to a point 2,000 feet above, have a choice of two routes (a) a narrow slope that will require about 35 traverses and kick turns (b) a broader slope that will require about 15 traverses and kick turns. You are climbing on an exact 20° grade; that is, you travel 1,000 feet horizontally for each 200 feet of vertical elevation that you gain.
- What is the horizontal distance you travel on route b? _____
- How much less horizontal distance would you travel on route a? _____
- Which route would take the most energy? _____
24. A party is breaking trail through deep, soft snow. Some of the party members are getting noticeably tired. Should you
- Stop the party and give it a rest, thus losing time.
 - Excuse the tired members from further trail breaking and keep going.
 - Send the tired members home by themselves.
 - Send them home with one of the stronger members of the party.
 - Leave them at a comfortable stopping place, with orders to wait until the party came back.
25. You should never carry an extra set of clothes in the car, because ski clothes are water repellant. True or False
26. Given the following methods of climbing (A) Herringbone (B) Long traverses (C) Sidestepping (D) half sidestepping (E) Short traverses (F) Take skis off and walk on crampons. What would you recommend for the following:
- Long open 20 degree slope, 4 inches of powder on a crust _____
 - Short steep pitch on a narrow ski trail, 18" new snow _____
 - Short steep pitch on a narrow ski trail, packed snow _____
 - Steep narrow slope covered with unbreakable crust _____
27. It's o.k. to leave your snow glasses home in the winter. T or F
28. George McPrexy blames his skiing spills on the fact that his packsack gallops back and forth on his back, upsetting his balance. Should he
- Wear the rucksack on his stomach.
 - Get a Bergan type packsack. _____ in his pocket.
 - Throw the pack in a crevasse and carry his equipment/
 - Invent straps which will anchor his small pack.

GENERAL Northwest CLIMATIC CONDITIONS

I. GEOGRAPHIC CONSIDERATIONS.

- A. Cascade Mountains to the East and Olympic Mountains to the West form natural physical barriers.
- B. Proximity to Japanese Current causes circulation of warm air currents.
- C. Extreme height of higher peaks and ridges above main range of Cascades.
- D. Weather conditions usually governed by pressure areas in surrounding sections, causing sudden and frequent changes in weather.

II. TEMPERATURES.

- A. Usually ranges at altitudes over 2500 feet from 25 to 40 degrees F. during winter months.
 1. During stormy periods we may expect a temperature drop at ratio of 3 degrees per thousand feet of elevation rise.
 2. Temperature inversions in settled weather.
- B. May be varied temperatures at varied heights--sometimes warmer at higher elevations than at lower heights, due to influence of warm air currents.

III. WIND.

- A. Southwest winds bring most precipitation.
- B. Southeast winds bring stormiest weather at higher elevations.
- C. Northerly winds usually bring cold clearing weather in winter.
- D. Westerly winds bring rising temperatures, clearing weather.
- E. Chinook winds--warm wind from South or Southwest.
 1. Has particular danger of melting snow on ridges while leaving valley snows in colder or hard conditions, creating danger of avalanches from above.
 2. May be expected at any time of the year.

IV. PRECIPITATION.

- A. Formation and Deposits.
 1. Snow or rain is formed by rising air masses on the mountain sides.
 - a. As winds blow into the mountains they strike the windward slopes and are deflected upward. Decreasing pressure as elevation increases causes expansion and cooling.
 - b. When dew point is reached the saturated air deposits water either as ice or fog.
 - c. Small ice particles falling pick up water to form snowflakes.
 - d. In the Cascades, cold air currents from the East increase this action.
- B. Depth of Snowfall.
 1. Elevation.
 - a. In normal years heaviest fall is between 2500 and 9000 feet elevation.
 - b. Past three years abnormally light fall between 4000 and 10,500 feet elevation.
 - c. No basis for determining at what elevation snow lies heaviest as it varies in relation to locality, but 5000 foot elevations usually receive heaviest fall.

2. Location,
 - a. Western slopes and crest of Cascades received heaviest fall.
 1. Prevailing winds are southwest, so therefore southwest and west slopes receive heaviest precipitation.
 2. Examples--Paradise, south slope--Heather Meadows, west slope--Southwest and western sides Olympics.
 3. May expect longer skiing season on westerly or southern slopes.
 - b. North winds bring cold clearing weather, therefore light precipitation.
 1. Examples, Carbon Glacier--Deer Park,
 2. May expect better winter skiing conditions on north or east slopes.
 - c. Low valleys leading East into Cascades lead winds into pockets, sometimes causing heavy snowfall at low elevations.
 3. Total depth of snow affected by type of snowfall, and rate of evaporation and melting.
- C. Season of snowfall.
1. Usual snow season from December 1 to April 1.
 - a. Varies with season.
 - b. Sometimes good skiing as early as middle of September.
 - c. May be as late as middle of December.
 - d. May usually find skiing at higher elevations through October and November.
 - e. March is normally heaviest snow month.
- D. Types of snowfall.
1. Dry Snow (Powder)
 - a. Falls at temperatures 25 degrees F. and under.
 - b. Rare in Northwest as cold northerly winds usually bring clearing weather.
 - c. High moisture content of air usually prevents freezing out of damp snow.
 2. Damp Snow.
 - a. Falls at temperatures of 25 to 32 degrees.
 - b. May seem powdery in appearance but will ball in hand.
 3. Wet Snow.
 - a. May fall at ground temperatures as high as 36 to 38 degrees, or as low as 30 degrees.
 - b. Caused by ice particles falling through warmer air strata, causing increase of moisture content of snowflakes.
 - c. Heavy and soggy, and is characterized by large flakes.
- E. Rain.
1. Usually with southwest wind.
 2. With Chinook wind will occur at any time during winter months at any elevation up to 9000 feet.
 3. Will rain at ground temperatures as low as 27 degrees, usually resulting in formation of ice known as the silver thaw.

SNOW SURFACES ENCOUNTERED WHILE SKIING

I. NEW SNOW.

- A. Powder snow.
 - 1. Light and fluffy, may be lightly wind packed.
 - 2. Settled snow--has not formed crust and is skiers' special delight.
- B. Damp snow.
 - 1. Frequently light, but will ball in hand and sticks easily to clothing, etc., may be slightly wind packed.
 - 2. Due to increased moisture content, adheres readily to strata on which it falls.
 - 3. Settled damp snow--unaffected by temperature rise, and as yet uncrusted.
 - 4. Damp snow when affected by lowering temperatures tends to slow ski sliding.
- C. Wet snow.
 - 1. Heavy, wet flakes.
 - 2. Packs readily, but due to excess moisture content heavy fall will tend to create avalanche conditions.

II. Changes Which Take Place in Fallen Snow.

- A. Moisture-laden currents or wind change nature of snow.
 - 1. Blows loose snow off ridges and deposits it on lee side as cushions.
 - a. Dangerous until solidified as firm snow.
 - 2. Wind Slab.
 - a. Formed if snow DRIFTS during wind on lee sides of ridges. (Very little powder snow in northwest causes very little genuine wind slab to be formed.)
 - b. Slab is dangerous because it has little adhesion to strata beneath and is easily broken away from the hill.
 - 3. Wind Crust.
 - a. Formed if snow does not drift.
 - b. Prevalent in Northwest and usually quite safe.
 - c. May be breakable or unbreakable. (These terms are usually defined in terms of a man on skis.
 - c. Forms excellent anchorage with strata beneath.
 - 4. Light Wind Pack.
 - a. Breakable crust, usually quite thin, caused by direct wind action, usually by gentle winds.
 - 5. Cornices and snow bridges.
 - a. A combination of wind-driven snow and water laden air congeals snow in quiet air pocket on the leeward side of slope.
 - 6. Marble Crust.
 - a. Crusted snow which through contact with heavily-laden moist air currents becomes ice. This is found in the Northwest on ridges or open slopes.
 - 7. Scooped surfaces.
 - a. Caused by wind action blowing snow from behind natural obstacles, such as rocks, trees, etc., forming hollows in the snow.
 - b. Useful to skier in determining wind reactions and to study stratification of snow.
 - 8. Ridged Surfaces.
 - a. Caused by snow blowing through gaps in natural obstacles, such as rocks.

- b. Usually adhere firmly to under strata.
 - c. Built up above snow line, or caused by scooping action of wind in making furrows below the snow line.
 - d. Frequently found on the ridges.
- B. Effects of temperature and moisture upon snow surfaces.
1. Rain crust.
 - a. Caused by increasing moisture content of snow by rainfall directly upon the surface, followed by lowering temperature and freezing.
 - b. May be breakable or unbreakable.
 - c. Sometimes light drizzle falling on loose new snow will form thin ice crust, easily breakable, forming knife like edges very wearing on a skier's shins.
 - d. When re-softened through rise in temperature through sun or wind rain crust is usually slower running than sun crust or film crust.
 2. Sun crust
 - a. Formed by increasing moisture content of snow through melting and subsequently freezing.
 - b. Usually unbreakable.
 - c. When superficially melted forms perfect running surface.
 - d. Gets soft and sloppy with continued melting.
 - e. Granular in character.
 3. Film crust.
 - a. Formed by freezing of snow melted in droplets by sun.
 - b. May be distinguished by shining surface.
 - c. When melted by rising temperature forms excellent skiing base.
 4. Wind action on crust.
 - a. Despite sun and rise in temperature wind action on snow will keep crust from melting on windward side.
 5. New snow and rising temperatures.
 - a. Rising temperature after new fall of powder or damp snow will tend to make snow slow and cloggy.
 - b. Rising temperature after new fall of wet snow indicates avalanche conditions.
 6. Evaporated crust.
 - a. Light fall of snow upon frozen strata beneath will evaporate causing disintegration of support to lower strata, making conditions which will cause the evaporated strata to slide easily.
 - b. Identified by spongy appearance.
 7. Spring powder.
 - a. Snow which has fallen on north slopes (or east in the NW) and though dampened by high temperatures does not crust because sun does not fall upon it.
 - b. Found in isolated spots, usually under steep walls or ridges.
 8. Rain.
 - a. Has softening action on both crust and loose snow.
 - b. Increase moisture content of snow.
 - c. Forms furrows known as rain troughs, causing roughening of snow surfaces.
 9. Frozen snow.
 - a. Fall of snow which has become thoroughly impregnated with moisture and has frozen into a unit, rather than crusting on the surface.
 - b. Usually identified by rough surface of snow.
 - c. Adheres solidly to under strata, and moisture finds it difficult under thawing conditions to seep through strata

to lubricate under surface.

10. Sun cups.

- a. Formed by evaporation of snow in sheltered areas, leaving harder sections remaining, which form miniature snow peak on the surface.

11. Hoar frost.

- a. In clearing weather fog and clouds are forced downward causing fog particles to sublimate directly upon the snow surfaces.
- b. Hoar frost on crusted surface affords superb skiing surface.

C. General considerations.

- 1. Rising temperatures, through evaporation and melting tend to settle snow.
- 2. Lowering temperatures, through freezing, tend to solidify snow.

III. STRATIFICATION OF SNOW.

A. Each snowfall, through changes in moisture, temperature or wind lies in individual strata.

- 1. Type of snow in strata is determined by conditions under which it was formed.
- 2. Weather conditions under which strata was formed may be determined from examination of strata.

B. Angle of slope to wind and sun determine rate of melting.

TOURING AND WAXING

I. JUDGING CONDITIONS.

A. Knowledge of conditions essential for waxing.

B. As weather conditions affect snow surfaces the following items should be checked before going on tour.

- 1. Temperatures.
 - a. Note at what time and elevation readings were taken.
- 2. Humidity.
 - a. There will be precipitation usually if humidity exceeds 100.
- 3. Wind direction.
- 4. The barometer may also be consulted but it is not considered a reliable guide in this area. Lowering barometer frequently means clearing weather, rising barometer stormy weather.
- 5. Weather trends.
 - a. Will determine whether weather will be stable or uncertain
 - b. Be prepared for sudden weather changes and therefore changes in snow surfaces.
 - c. Check snow conditions before last snowfall.

C. A varied assortment of snow surfaces may be found on a single tour, due to

1. Elevation.

- a. As clouds are pushed higher against the mountain ranges they strike colder air currents which cause different types of precipitation. Thus you may find rain at 3000 ft wet snow at 3500, damp snow at 4500 and powder snow at 5500.
- b. In settled or old snow definite boundary lines frequently exist between different snow surfaces.

2. Location.

- a. Snow surfaces vary according to position of slope and angle to sun.

(1) In both ridges and valleys you may find wet or granular snow on one side and damp or powder snow on the

other.

- b. On ridges you may find at times three varieties of snow, such as spring or granular snow on the sunny slope, wind pack on the crest and powder snow on the sheltered side.
- c. In valleys or on ridges after new snow falls there will be loose snow on sheltered sides and wind crust on exposed side.
- d. Surfaces between shaded and sunny slopes, open and wooded slopes.

D. From study of snow surfaces encountered on tour it may be possible to check direction and elevation.

E. Some general precautions to take while on tour.

1. While ascending slopes check snow surfaces for reference for the return run.
2. Proceed cautiously while descending unknown slopes, particularly if foggy or cloudy. Check snow surfaces before crossing new areas.
 - a. Avoid fast running in unknown conditions, it will save you spills on suddenly striking slow sticky surfaces, or prevent going over a cornice or on to unsuspected avalanche slope.
 - b. Evaporation of snow will cause soft spots around natural obstacles.
 - c. Last snow strata may lightly cover natural obstacles.
 - d. Sudden running from wet snow into damp or powder snow will cause icing of skis.

BE SURE OF YOUR CONDITIONS----BE SURE OF YOUR SLOPE!

II. Waxing.

A. Reasons for waxing.

1. Increases ability to manoeuvre.
 - a. Proper waxing increases control of your skis.
 - b. Skins or socks would have to be removed for glacier travel or on slopes liable to avalanche!
2. Safety.
 - a. Edge control.
 - (1) Ski socks cannot be edged properly and therefore would be unsafe in hard snow, or when traveling roped through crevassed areas.
 - (2) Can edge in sealskins. Only one type of skin has been developed on which skier can run with the Sohm skin, but it takes considerable time to apply them.
 - b. With climbers you lose ability to run away from impending dangers.
3. comfort (Comfort)
 - a. Properly waxed skis will climb as easily and readily as climbers.
 - b. Waxed skis easier to lift and slide, thereby lessening possibility of fatigue.
 - c. No wet or frozen climbers to fuss with.

B. Proper wax to use is governed by 3 factors.

1. Temperature of the air.
2. State of the weather.
3. Nature of the snow surface.

C. Wax types.

1. In general, hard waxes are good running waxes, and some will climb also in new dry or damp snow.
 - . Soft waxes run in clogging snow and some will climb. Others climb well in dry snow.

II. WAXING (continued)

- C.
 - 3. Klister types are for thoroughly wet snow.
 - 4. Skare types are for frozen snow.
 - 5. Speed waxes are usually hard and are for downhill running only. Come in useful in waxing in combinations.
- D. How to wax.
 - 1. A good base wax is essential.
 - a. A pine tar base (Skare is good) is best for your skis if you go in strictly for touring. Burned into wood with blow torch or other heat it provides substantial base for other waxes. (Not for laminated skis)
 - b. Lacquer or graphite base is now the prevailing idea in ski bases. Forms hard surface on bottom of ski and is especially good for downhill running.
 - (1) For touring it is advisable to wax first with Skare before putting on your running waxes.
 - 2. Follow directions for waxing for that particular wax only.
 - 3. Thumb and palm of hand are best implements for applying wax.
 - 4. Rub wax from tip of ski back.
 - 5. Apply wax with skis as cool as possible and still keep wax workable. Let skis cool to air temperature after waxing. When they cool, place them on the snow before using them. If possible, run skis first through unpacked snow.
- E. Waxing on tour presents more problems than same operation at home or at lodge.
 - 1. Skis should be dry and warm for waxing.
 - 2. For camping overnight.
 - a. If possible, bring skis into tent with you.
 - b. Wipe skis off carefully and place in sheltered spot.
 - c. If skis are used as tent poles, be sure they are thoroughly dry (if possible) to prevent icing.
 - 3. Always carry a wax scraper and a cloth with which to clean and dry skis.
 - 4. Carry wax in trousers pocket to keep it soft and workable.
 - 5. Carry sufficient variety of your own waxes to meet any condition of snow surface conditions encountered.
- F. Waxing in combination provides adequate climbing and sliding for conditions not specifically covered by any particular type of wax.
 - 1. Effective combination is Skare base with climbing or downhill wax.
 - 2. Climbing waxes touched up with new snow waxes.
 - 3. When encountering difficulty in climbing, touch up skis under the foot with climbing wax.
- G. Experience is the best way to learn waxing.
 - 1. Select fine varieties of waxes and learn how to use them correctly.
 - 2. Find out for yourself what wax works best under given conditions.
 - 3. Waxes may not always be suited to local conditions as specified by the wax maker.
- H. To summarize.
 - 1. Proper waxing increase the enjoyment and safety of ski touring.
 - 2. Be prepared to wax for varying conditions.
 - 3. Learn from experience what waxes to use, and how best to utilize them.

WAX CHART

Compiled December, 1934 - Revised October, 1941

Crust or Frozen Snow		SKARE							
Spring Snow									Klister
Raining Very Wet Snow									Klister
Old or Cloggy Damp Snow									Northland 2 Star
New Damp or Cloggy Snow									Red Dunzinger
Powder Snow									Black
New Dry Snow		OSTBYE MIX							Dunzinger
Temperature	10	20	28	30	32	34	36	40	50
	Under Freezing				Over Freezing				

EXAMPLE: Temperature 31, new cloggy snow -- Use Red Dunzinger

APPROXIMATE GROUPING OF WAXES FOR COMPARISON

Wax	New Dry Snow	New Snow Near Freezing Point	Cloggy-Snow	Wet Snow	Crust	Base Wax	Speed Wax
Avalanche	Medium				Medium	Graflac	
A. & T.	601	#8		602	603	Durolac & #6	604 & #9
Cascade	Dry Snow Wax			Klister		Marvelac	Silver Streak
Dee-Bee	Skimont			Alta		A-21 Grant	pa
Dunzinger	Black		Red	Klister		A-21	Blitz
Eastwood	Green	Orange		Orange		Baselac	Blue
Metro	Yellow						Yellow
Mountain King	Dry Snow Wax						
Northland	1 Star		2 Star	3 Star		Skilac	5 Star
Osbye	Mix		Klister-vox	Klister	Skare		Schuss
Schneider	Hard		Medium	Soft		Speedlac	Parafin
Sohms	Blue		Orange	Gold		Durospeer	Red
Wilby	Yellow	Red	Blue			Silverlac	

Other base waxes: Ski-Pro, Vitric, Skigliss, Skarelac, Wizard Lacquer.

Other speed waxes: A*X Graphit Parafin, Pfeiffer's Topspeed Silver, Medium hard and perfect parafin.

WEATHER AND SNOWCRAFT QUESTIONS

1. Precipitation is caused by the cooling of rising air masses on the mountains. True or False?
2. When temperatures drop below 32 degrees, precipitation is always in the form of snow. True or False?
3. At Mt. Rainier, the heaviest snowfall is at the summit. True or False?
4. _____ areas govern weather conditions in the Northwest and cause (many) (few) and sudden changes.
5. Winds causing the most precipitation come from (1) north, (2), southeast, (3) northwest, (4) southwest, (5) east, (6) north-east.
6. Northwest snowfall is determined by
 - (a) Cold currents of air forced to pass high above Japanese Current.
 - (b) Moisture laden air currents rising against mountain barriers.
 - (c) Weather forecast from San Francisco.
7. Sally Sitz and Sam Slides on a tour find that at Camp Muir the temperature is 27 degrees and it is snowing from the southwest. What are the snow conditions at Paradise?
8. We may expect longer ski season on south and west slopes because
 - a. Most ski resorts are located there.
 - b. Heaviest snowfall.
 - c. Most accessible from Puget Sound area.
9. After a warm sunny day the night temperature drops to 27 degrees, what snow surface would you expect to find the following morning, weather conditions remaining the same?
10. Rising temperatures tend to
 - a. Expand snow.
 - b. Settle snow.
 - c. Crust snow.
 - d. Form sun cups.
11. Wind crust
 - a. Is formed if snow drifts. True or False?
 - b. Creates avalanche conditions. True or False?
 - c. Is unbreakable. True or False?
 - d. Is formed if snow does not drift. True or False?
12. Marble crust is soft and breakable. True or False?
13. A Chinook wind is a
 - a. Warm Southwest wind. True or False?
 - b. Sign of good ski conditions True or False?
 - c. Talkative Indian. True or False?
 - d. Warm north wind. True or False?
14. Powder snow makes grand snowballs. True or False?
15. Rain, falling directly upon the surface of the snow, with rising temperatures causes rain crust. True or False?
16. Each snowfall, through changes in moisture, temperature and wind, assumes the same characteristics as the previous falls. True or False?
17. Having observed that the wind has shifted to the Northwest after several days of Southwest storm, would you expect the weather to (a) break or (b) storm?
18. Assuming all slopes to be equally skiable, on which slopes would you find the best ski conditions after a violent southwest storm with the temperature about 29°, North, South, East or West? Three days later - clearing weather and cold north wind? Two days later after warm days and freezing nights?

19. After several days of settled weather, if you were on a trip in the morning, and you felt a southwest breeze springing up, what conditions would you expect that same afternoon? Two days later?
20. If it snows when a North wind is blowing, will it be apt to be (underline correct answer):
- Cold dry snow or damp snow.
 - Will it snow heavily or lightly.
 - Would you expect it to clear within a few hours or snow for three days.
21. If the temperature in Seattle at sea level is 45° , with a Southwest wind blowing, what is the approximate temperature at Paradise Valley at elevation 5500? _____
 What kind of snow will you expect to find: (a) dry powder snow, (b) damp new snow, (c) damp old snow, (d) wet spring snow (e) rain crust. (Mark one)
22. Your pal reports back with great enthusiasm of the fine dry powder snow skiing in Snoqualmie Pass. You read in the paper that the minimum temperature has been 30° . Is your friend a liar? Yes or No.
23. You are skiing at Paradise Valley in a heavy fog and a light North wind. You decide that by going up high near McClure's Rock you may be able to get above the clouds. Are your chances good, bad, or indifferent?
24. You arrive at the Meany Ski Hut at elevation 2900 on the East side of Stampede Pass, anticipating good snow because temperature is reported to be 22°F . You step out of the train to find it raining. What is the best explanation?
- The Northern Pacific Railroad has falsified reports to draw skiers.
 - The thermometer was wrong.
 - Warm air from the West is overriding the cold air from the East.
25. There has been alternate thawing and freezing for several days. You are skiing on an East-West ridge. Will you find the best snow on the North or South side if
- Bright sunshine and cool day (temperature 35°) _____
 - Bright sunshine and warm day. _____
 - Cloudy, warm day. _____
 - Cloudy day, temperature below freezing. _____
26. A strong Southwest wind has been blowing for two days. Temperature at 5000 feet is 30 degrees. What kind of snow surface will you find on the following trips?
- High trip on ridges above timberline _____
 - Up and down traverse at timberline _____
 - Trip in the trees at about 4500 feet _____
 - Will (a), (b), or (c) give the best skiing.

AVALANCHES

I. AVALANCHES DEFINED.

Avalanches are the sliding and/or fall of snow and/or ice down a mountain slope.

There are two types of avalanches:

Ground avalanches in which all snow slides off leaving ground bare.

Superficial avalanches which is the sliding of masses of snow over other layers of snow. Superficial avalanches are the most common.

II. CLASSES INTO WHICH AVALANCHES FALL AND THEIR CHARACTERISTICS.

A. Dry Snow Avalanches.

1. Causes:

Large quantity of snow. As very little dry snow falls in Northwest, the danger from dry snow avalanches are considerably less than those caused by wet snow.

Low internal cohesion. The snowflakes are so light they "float" rather than adhere into solid mass.

Low external adhesion. Poor anchorage to strata beneath.

Angle of slope. Any slope above 22 degrees is possible danger.

Orientation with respect to sun.

2. Characteristics.

Gradual release by harmless looking snow slide, or sudden release when support breaks away.

High velocity with little noise.

Much pulverization and with air blast accompanying.

Avalanche tip is light and fluffy.

B. Wind Slab Avalanches.

1. Causes:

Little or no adhesion to lower layers. Some slabs are actually dome shaped, with support only at outer edges.

Wind slab is unstable because of stresses set up during formation.

Breakage of slab, through external influences, destroys all anchorages since slab collapses.

2. Characteristics:

Usually found only in winter.

Consists of great blocks of snow.

Particularly dangerous because frequently entire slope will peel off. (Meany Hill wind slab avalanche of 1931)

Will slide on relatively level slope.

C. Ice Avalanches.

1. Causes:

Natural movement of glacial ice causes pressure from behind, forcing section of ice over slope or cliff.

Sun striking ice wall will cause sections to fall from weakening or melting of supporting structure.

Sun alone will not cause ice avalanches. In reverse, freezing of ice after warm day will expand supporting structure causing its weakening.

C. Ice Avalanches (continued)

2. Characteristics:

Ice falls in various quantities, from small slivers to huge masses.

Usually announced by "thudding" noise, as well as "roar" as ice falls.

May start other avalanches by falling onto dangerous snow slopes beneath.

D. Wet Snow Avalanches - Northwest Weather Conditions Make These Our Chief Danger.

1. Causes:

Great weight of snow layer. The deeper the layer the greater the danger.

Low internal and external cohesion due to lubrication of water.

Angle of slope. May slide on gradient as low as 15 degrees.

Sudden changes in weather and temperature.

2. Characteristics:

Frequently preceded by rolling sun balls.

Snow slides in waves; series after series of avalanches.

Little pulverization is present; snow rolls as balls with a swirling motion.

As soon as avalanche stops, it freezes solid.

Due to tremendous weight immense damage can be done.

Travels at comparatively slow speed.

In the Northwest tracks through forest may indicate frequently recurring avalanches.

III. CONDITIONS WHICH GOVERN AVALANCHE DEVELOPMENT.

A. Nature of the Terrain.

1. Narrow river valleys of Northwest, with their steep slopes favor the development of avalanches.

a. Avalanches pile up in narrow valleys, spread out in flat valleys.

b. All slopes over 20 degrees should be suspected. Wet snow avalanches will slide at 15 degrees.

2. The contour of the slope is an important factor.

a. A concave slope, unless the snow is wet, is usually safer than a convex slope because weight of snow itself tends to compress and stabilize it.

b. In the Northwest a wide variety of contours may be found in single slope causing danger of one dangerous slope converting otherwise safe slope into potential danger spot.

3. Steep gullies form natural avalanche tracks.

4. Steep ridges with strong winds increase formation of cornices.

5. Ledges on which snow catches and collects are a frequent source of avalanches, when snow from the ledges fall onto slope below.

6. Natural laws of avalanches are not so readily applied on slopes cut artificially, such as roads, etc., as the natural contour of the slope is destroyed.

7. Some steep slopes never avalanche, even though in otherwise favorable conditions, due mainly to action of moisture laden winds.

III. B. The Nature of the Underlayer.

1. Natural underlayers.
 - a. Rocks, as rockslides, form substantial retarding influence to sliding snow, until they are entirely covered by snow layer.
 - b. Slabby rocks, frequently found in the Cascades form dangerous underlayer at all times. Sometimes natural heat of rocks cause snow to melt on rock surfaces, making snow support fragile and easily broken away.
 - c. Upthrust nature of Cascades makes formations of slab one side of ridges, steep cliffs on the other.
 - d. Frozen bare earth is dangerous.
 - e. Heather and grass slopes, especially if grass is long, is poor undersurface for snow.
 - f. Vine maple and alder will hold snow securely as long as trees project above snow surface. After trees are bent down by weight of snow they act as natural shoot-the-shoots.
 - g. Abundance of timbered slopes is distinct advantage in Northwest, as trees hold slopes from sliding. However, do not be under the delusion that because you are in timber that you are always safe from avalanches falling from above.
2. Snow underlayers which may be considered dangerous.
 - a. Unbreakable crusts--rain, sun and marble.
 - b. Wind slab--new snow may disguise this danger.
 - c. Loose snow--additional weight of new layer may precipitate sliding depending upon condition of the undersurface of first fall.
 - d. Hoar Frost--provides weak bond between snow layers.
 - e. Old wet snow--is apt to lubricate bond between falls of snow.
 - f. Evaporated crust--any wet fall of snow on crust is dangerous as it lubricates underlayer especially if crust has been rained on.
3. Snow underlayers which may be considered safe.
 - a. Loose snow if falling snow is of same general character.
 - b. Wind crust is usually safe.
 - c. Ridged and scooped surfaces, and sun cups. Conditions favoring the formation of these surfaces do not favor avalanches.

IV. SOME IMPORTANT CONSIDERATIONS IN THE STUDY OF AVALANCHES.

A. Northwest snow conditions.

1. Powder snow.
 - a. Powder snow avalanches depend upon great masses of snow. As very little of this type of snow falls in this section, there is very little danger of genuine avalanches. However, when powder snow falls upon hard crust, there is the danger of small slides on steep slopes.
2. Damp snow.
 - a. Moisture tends to adhere snow, and even heavy falls of damp snow will not tend to avalanche until affected by thawing conditions.
3. Wet snow.
 - a. Wet snow will easily avalanche due to the over-weighting of snow by water.
 - b. Depth of snow will be slight in comparison to its

IV. SOME IMPORTANT CONSIDERATIONS IN THE STUDY OF AVALANCHES (cont.)

- weight. Wet snow is sometimes ten times the weight of the same volume of powder or damp snow.
4. Notherly storms usually mean weather will clear shortly. Southerly storms usually mean a period of sustained bad weather and therefore heavy precipitation.
 - B. Internal conditions of snow determine its safety. After falling, snow undergoes physical changes which will tend to form avalanche conditions.
 - C. Through becoming wet, the weight obviously becomes a factor, especially with heavy accumulations. Water increases mass of snow.
 - D. How snow becomes wet.
 1. Thawing.
 - a. By direct action of the sun.
 - b. Due to high Northwest humidity, condensation takes place causing heat to be set free from snow surface, thereby raising surface temperature.
 - c. Cloudy skies check surface heat radiation. This will vary with angle of slope and height of clouds.
 2. Fog or mist.
 3. Capillary action.
 4. Chinook Winds and rain.
 - a. Most important condition of all in point of danger due to quickness with which avalanche conditions are created. It has been known to affect snow in an hour's time to such an extent as to create really dangerous conditions. Do not venture into potentially dangerous avalanche areas if weather conditions indicate possibility of Chinook. Danger is minimized during Chinook as no respectable skier will venture forth on tour under those conditions.
 - b. Freezing weather following Chinook will solidify slopes again, but following next fall of snow avalanche, conditions may again appear in the new snow.
 - c. Rain upon snow increases danger of strata being lubricated before next fall.
 - E. Location of avalanche slopes.
 1. Elevation--avalanches may be expected at any elevation at which snow falls in any quantity. Those elevations--around 4000 to 5500 feet--where snow falls heaviest are naturally the most dangerous. Lower slopes also receive most rain.
 2. Orientation.
 - a. South and west slopes receive the heaviest precipitation as well as most thawing and rainy weather and should therefore be more often suspected.
 - b. Many valleys run east and west, and north slopes under these conditions should also be treated with respect.
 - c. Slopes that receive most sunshine. Sunny slopes will avalanche first in warm weather. Shady slopes may be dangerous for several days.
 3. Physical characteristics of the avalanche slope.
 - a. The contours and steepness of the slope.
 - b. The nature of the underlayer,--slabby rock, heather and grass slopes, alder and vine maple slopes should be treated with care

IV. SOME IMPORTANT CONSIDERATIONS IN THE STUDY OF AVALANCHES (cont.)

3. c. Steep walls, especially if snow lodges on the ledges.
- d. Corniced ridges.
- e. It is important to know that the heavier the snow layer the flatter the slope required to hold the snow mass.
4. Special characteristics of wet snow avalanches is that they frequently follow the same tracks year after year. However, due to varying conditions, wet snow avalanches may fall at any given place given proper conditions.
5. Narrow valley bottoms are dangerous in avalanching conditions as snow piles up in heavy masses in valley bottom.

F. The time element.

1. Under Chinook conditions, avalanche danger is present at any time during day or night.
2. Cloudy skies bring danger of sliding snow during warm period of day.
3. Under ordinary thawing conditions (sun, etc.), danger may exist from the time sun first hits snow.
 - a. On slopes hit by sun throughout day, maximum danger is usually around 2 o'clock in the afternoon, when sun's rays have most effect on snow slope.
4. When sun hits slope, it may bring down avalanches due to expansion and weakening of snow support. This is true of both snow and ice avalanches.
5. When sun leaves slope, it may bring down avalanches by release of stresses by expansion due to freezing.
 - a. Continued thawing lubricates snow particles and understrata. When shadow passes over slope, the surface freezes leaving slope in uncertain state of equilibrium, and may be set off by undue stresses.
6. The season of the year.
 - a. The fall season brings special danger of frozen underlayer of ground surfaces over which new wet snow will slide easily.
 - b. The nature of the snow stratification determines the danger during the winter season, together with weather conditions.
 - c. The quantity of snow deposits, together with the amount of thawing and the configuration of the slope figure into spring and summer avalanches. Danger from falling cornices is increased as they have multiplied their weight through increased water content.

V. SOME FACTORS CAUSING THE SETTING OFF OF AVALANCHES.

- A. Changes in temperature and settling of snow through gravity causes changes in stresses in the snow mass.
 1. A drop in temperature causes changes in size of snow crystals and therefore makes for less cohesion.
 2. Temperature rises may cause expansion of snow.
 3. Settling of snow increases moisture content, and thereby the weight.
- B. Outside influences in the starting of avalanches.
 1. Skiers crossing the slope.
 - a. Due to the length of skis and the fact that a track is made that cuts the entire slope, the danger of skiers starting avalanches is greater than that of a man crossing the same slope on foot.

- b. If snow layer is thin skis will break entire support of slope.
 - c. If snow layer is thick or heavy the danger lies more in the lack of internal cohesion in the snow itself rather than the setting off the entire layer. Under these conditions the danger of crossing the slope on foot or ski is perhaps equally great.
 - d. Undercutting the slope. This is the greatest danger as wet snow avalanches slide in waves, and the upper section will slide over the lower part of the slope.
 - e. The pressure of skiing turns will set off avalanches.
2. A cornice, ice avalanche or snow falling from rocky ledges.
 3. Snow falling from trees.
 4. Natural heat around rocks will weaken the snow support.
 5. Ploughing out of roads break the natural contour and support of the slope.

VII. SOME GENERAL PRECAUTIONS.

- A. A knowledge of past meteorological conditions is essential to know the nature of the snow strata. Dangers of avalanche conditions depend not so much on nature of terrain as on the conditions of the layers underneath.
- B. Learn from experience where you may expect "normal" avalanche conditions and have such sections carefully marked on map.
- C. Study weather forecasts. In the Northwest this service is poor, as forecasts come from San Francisco, so that sudden weather changes are recorded too late to be of practical value. It is best to learn weather for yourself.
- D. A record of snow depths.
- E. Study of snow sections.
 1. Sounding with ski pole.
 - a. If pole is pushed readily into snow (handle first) it will indicate that internal cohesion of snow is poor, either through thawing, from cold or dampness.
 - b. If strata underneath cannot be penetrated, determine from upper layer possible danger of lubrication between the strata.
 2. Snow sections may be studied in hole around trees, with very little digging, or by observing heavily scooped surfaces.
 3. Study of snow sections can give you exact details of weather trends in areas in which weather reports are not available.
- F. Note variations of snow surfaces in regard to location and orientation.

VII. Tactics on avalanche ground.

- A. Where ever possible, avoid avalanche slopes, especially
 1. Short slopes over steep cliffs.
 2. Long steep slopes.
 3. Slopes under cornices and cliffs.
 4. Steep gullies, especially if they branch above into two or more divisions.

KNOW YOUR SLOPE*-KNOW YOUR WEATHER

- B. Crossing avalanche slopes (suspected)
 1. Where ever possible cross slope as high as possible, except under a cornice. Follow the ridge if possible.
 2. Avoid direct traversing, if possible. If descending, run straight at a sharp diagonal across slope. If ascending do not switchback. Take off skis and climb straight up on foot. Unless it is essential for the welfare of the party the sensible thing to do would be to turn back rather than ASCEND avalanche slopes.
 3. Do not turn on dangerous slopes if possible. Do not ever jump turn. The faster your turn, if you have to do it, the greater the impact on the slope, and the greater the danger of avalanching.
 4. To walk or ski.
 - a. If terrain is difficult, and slope steep it is best to walk. Boots will compress snow and tend to keep or increase its cohesion. Take long steps and take care not to make definite channel across slope. If snow layer is shallow the feet will bite through

into harder strata beneath. If snow layer is deep, danger is probably equally great on ski as on foot.

5. Roped or unroped.

- a. If slope is wide the rope should not be used. Skiers should keep at least 200 feet apart and if possible should not run in the same track.
- b. If slope is narrow, such as a gully, and good anchorage is to be had, by all means rope up.

C. Some suggestions.

1. The importance of having a capable leader to make decisions as to safety of the slope and technique to be applied.
2. Don't cross a suspected slope merely because there is already a ski track across it. Conditions may have changed since the passage of the last skier.
3. If an avalanche has already fallen on a slope it is not necessarily safe. The fallen snow may have been the support for the snow above. The present avalanche track may also provide a natural shoot the shoots for succeeding slides.
4. Being in the woods does not necessarily mean you are safe from avalanches. Trees prevent slides from starting, but they can't stop the one that started higher up.
5. Skiing alone in avalanche territory should not be done. You shouldn't have started out alone in the first place.
6. Avoid traveling horizontally across bad slopes. The vertical or diagonal line puts less stress on the slope.
7. If traveling avalanche slopes in misty or foggy weather it is not necessarily essential to travel close together to avoid being lost. Unless it is also snowing heavily you can watch the ski track of the man ahead of you. Conditions that you meet should be the deciding influences.
8. In the Northwest sun balls rolling down a slope do not necessarily mean avalanche conditions. After falls of damp snow, it is frequently safe to cross even steep slopes after sun balls start rolling. However it is important to know your conditions.
9. It is possible to run over superficial wet snow avalanches which involves a light coating of snow. Do not attempt it if snow bulk is large.
10. Before crossing suspected slopes, loosen ski bindings, and remove wrists from ski pole straps, so that they can be easily discarded in case you get caught in an avalanche.
11. An avalanche cord is a heavy cord, usually red, trailed behind the skier in crossing suspected slopes. This string floats on the surface of the snow if the skier is overwhelmed and aids greatly in locating the victim afterwards. As it is a good thing to have some heavy twine in your ditty bag anyway, it might be a good idea to make it a red cord and use it as described above.
12. A man on skis will start more avalanches than a man on foot.
13. Members of a party should be separated by at least 200 feet when crossing an avalanche slope.

PROBLEMS FOR AVALANCHES AND WAXING

1. Skis are waxed in order to:
 - a. Strengthen arms for touring
 - b. Increase one's ability to maneuver on skis.
 - c. Give Sam something to do for Sally.
 - d. Keep Fibber McGee and Molly on the air.
 - e. So they may climb and slide easily in varying snow conditions.
2. What three factors govern the proper wax to use?
 - a. _____
 - b. _____
 - c. _____
3. To facilitate waxing on tour, Sally Sitz and Sam Slides should:
 - a. Carry a wax scraper. True or False?
 - b. Borrow wax from others to save weight in packs. T or F?
 - c. Carry most used wax in pocket (in can or tube) to keep it warm or soft. True or False?
 - d. Carry but one kind of wax. True or False?
4. After a warm sunny day, the night temperature drops to 27degrees. waether conditions remaining the same, how would you wax your skis the following morning? Wax? _____ Thick or thin? _____
5. What wax would you use under the following snow conditions? Would you apply it thick or thin? Smooth or rough?

	Skare _____	Thick _____	Rough(example) _____
a. Rain crust			
b. New snow, Temp 25'			
c. New snow; temp 30'			
d. New snow; temp 32'			
e. Cloggy snow 30'			
f. Raining, temp 34'			
g. New wet snow			
h. Hard firm snow			
i. Varving conditions, SW. wind temp. 30'			
j. Granular, spring snow			
k. Marble crust			
6. To increase climbing ability of skiers who slip backwards, it is best to smooth out wax under the foot. True or False?
7. In spring touring a single wax may be used as snow surfaces are all similar. True or False?
8. Under what snow conditions would you use the following waxes?
 - a. A & T 603 _____
 - b. Northland 2 Star _____
 - c. Garflac _____
 - d. Klistervox _____
 - e. Dunzinger black _____
 - f. Skare _____
 - g. Johnson's floor wax _____
 - h. Schneider medium _____
 - i. Eastwood Orange _____
 - j. Sohm's Red _____
9. Check the articles listed below which you would consider necessary for your waxing kit for a three day tour in April.

Mix	Klister	Red Dunzinger	Silver Streak
Dunzinger Black	Schneider medium	2 Star	Blitz
Sponge	Klistervox	Sohm's Orange	Baselac
Scraper	Sohm's Red	Skare	Gasoline
Vitric	Snow shovel	A&T 603	3 varities dr. snow wax

10. The directions for the use of any particular kind of wax apply to all varieties of wax. True or False?
11. You can always depend on someone else having the right wax to use under any given snow condition. True or False?
12. The greatest cause of avalanches in Washington is the Chinook wind. True or False?
13. Snow will not avalanche on a slope less than 23 degrees. T or F?
14. In general, the closer to the source of an avalanche you are, the greater the danger to you because you will be carried farther. True or False?
15. In very bad avalanche conditions, list in order of safety the following places to travel
 - a. On the slopes
 - b. Along the bottom of the slope
 - c. Along the bottom of the valley
 - d. Along the ridges.
16. After an avalanche has fallen, that part of the slope included in the track may be considered safe. True or False?
17. Numerous rocks sticking up in a ski slope help anchor the slope so that it is relatively safe from avalanche. True or False?
18. A slope of 15 degrees is safe to ski on under any circumstances. T or F?
19. Cornices, although beautiful, are dangerous to have above one when skiing. True or False?
20. Because there is a ski track across a slope, it is always safe to follow it. True or False?
21. For the sake of argument, we have four identical 30' slopes except that the ground cover varies. List in the order of safety with 24 inches of new snow resting on the ground.
 - a. Bare earth
 - b. Grass covered earth
 - c. Rockslide
 - d. Blueberry bushes
22. Bright sun is shining on damp snow. What time of day is it most likely to avalanche? Sunrise; 10:00 A.M.; noon; sunset.
23. Sun balls are an indication that a thaw is beginning. True or False?
24. One skier crosses a wind slab safely. It is, then, necessarily safe for anyone who is lighter to cross the slab. True or False?
25. You have elected to climb a peak which involves passing below some steep cliffs. You started on the trip after three days of fine cold weather following heavy snows. After spending the night on the mountain (but lower than the cliffs) you wake to find a howling Chinook wind blowing. You should:
 - a. Travel past the cliffs as rapidly as possible.
 - b. Travel as cautiously as possible so you won't make any noise.
 - c. Put on avalanche cords.
 - d. Practice turns on a 15 to 20 degree slope.
 - e. Go home.
26. In bad avalanche conditions you have a large slope of steep hillside to pass on the way home. You are a mile and a half from the road but the skiing is fast and easy. The sun is just setting and the weather is clear. What should you do?
27. You are camped on the north arête of a mountain and to get home you have to ski down 3,000 ft. of steep slopes. You have only enough grub to comfortably last the next day. In the morning you were climbing on thawing snow but it begins to snow at noon. Next morning you wake up at 5 A.M. and see that it is clear. You check the snow to find that there is about 14 inches of new powder snow. What should you do?
 - a. Descend at once.
 - b. Wait for the sun to come up, then descend.
 - c. Ration the grub and wait for the snow to settle.

27. (continued)

- d. Send up distress signals.
 - e. Finish the climb up the arete first, then descend.
28. In crossing a gully during avalanche conditions
- a. Rope together so that you can help the other members in the party if they get caught.
 - b. Ski straight across the gully.
 - c. If you have a rope, tie one man on it and find a good anchor at the other end.
 - d. Take off your skis and walk singly across the gully.
 - e. Take off your skis and cross singly on an ascending or descending line.
 - f. Ski downward diagonally across.
29. If caught in a Chinook wind when skiing on wet snow on a 20° slope, you should:
- a. Get off the slope as quickly as possible.
 - b. Put on something waterproof.
 - c. Start uphill to get above the Chinook.
 - d. Pray.
30. You find it necessary to ski along a narrow road which has not been plowed out, and which lies on a dangerous slope. Where would you ski?
31. Given the following past weather conditions: A prolonged fall of snow has been followed by a Chinook of such severity that it was raining hard at 10,000 ft. The wind gradually shifted to the north but no snow fell for two days. Then 12 inches of new snow fell. It is then:
- a. The best time to make that ski climb because the snow will be perfect.
 - b. Time to stay home because it is too cold to ski anyway.
 - c. Wisest to give long steep slopes a wide berth because they are dangerous.
 - d. A swell time to make a long trail trip through the forest.

ROUTE FINDING AND PARTY MANAGEMENT

Definition-

The art of finding one's way in unknown territory.

The art of finding one's way in known territory and adverse conditions.

This is important because of what happens if traveller is unskilled in route finding.

(a) Party because temporarily or permanently lost.

(b) Results in traveling over excessive distances.

Equipment-

The map is the most important tool. There are three kinds:

(a) Road map - shows features of general area and accessible roads. Obtained at service stations.

(b) Forest Service or Mountaineer map - shows trails and distances between points on these trails. Shows location of shelters and land marks such as lakes, rivers, etc. Obtained from Forestry Service.

(c) Contour map - shows absolute terrain of land and also some trails. Maps are usually over twenty years old and hence modern trails are not shown. The altitude at any point can be easily found by using the contour lines on the map. Obtained at book and map stores.

The compass is an instrument used for establishing direction.

Essential for use under conditions where visibility is poor as in fog, woods, storm and desirable at all times.

The compass is most valuable when used with a map.

The Taylor compass which costs about a dollar is recommended.

The aneroid altimeter is optional equipment.

Used for determining altitude.

Works on principle that air pressure decreases with altitude.

Use of Equipment-

Road map - Find proper roads and distances to starting point.

Forest Service map - Location of trails, peaks, directions, landmarks and approximate altitude of same.

Contour map - North is usually at top of map, orient the map to point North.

Determine the elevation from contour lines - A contour line is a line connecting all points of the earth's surface having the same elevation.

Elevation of climb or descent found by comparing contour line at start with that at end.

Steepness of slope determined by the horizontal distance between contour lines.

Position of ridges and valleys shown by contours.

Position and elevation of peaks shown on contour maps.

Shows position of glaciers, lakes and streams.

Maps should be mounted on cloth to preserve them and also kept in waterproof containers.

Horizontal distances from point to point may be scaled.

One can determine which landmarks can be seen from a given point.

One can determine which direction any point lies from a given point.

Compass-

Based on the principle that a magnetic needle points in a fixed direction.

Contrary to common belief, a compass at Seattle does not point North but N 23° E. Compass must be used with caution in certain areas where local mineral deposits may pull the needle off its fixed direction.

The angle between North and needle is called Declination.

To use compass, hold it level, steady needle down, turn compass scale so that the needle points 23° E of the North point on compass scale. Hold case fixed in this position, sight along proper mark on compass scale to establish desired direction.

Aneroid altimeter

Use is easy- just read your elevation off the scale.

When altitude is determined, you can spot your position on the contour map.

Principles of Route Location-

Uphill

Look for the easiest way. Avoid gullies and steep slopes.

Pick locations where snow is best. Do not blindly follow the summer trail as it frequently is not the best.

Look for flat or convex slopes, if possible, to keep weight on center of skis.

Select a route which travels upward on easy traverses, with as few kickturns as practical:

Avoid level travel as this produces no runback.

When climbing uphill, ski parties may make from 500 feet to 1500 feet per hour depending on snow, terrain, elevation and condition of party. Average party can figure on 300 feet per hour in average conditions.

Downhill

Select route providing best skiing - follow best snow and usually steeper slopes than uphill track.

Rate of descent on skis varies from 5 minutes to 1 hour per 1,000 feet drop, depending on terrain, snow conditions, skill and condition of party. Average party in average conditions should figure on 30 minutes per 1,000 feet drop.

General

Avoid dangerous spots such as crevasses, avalanche slopes, cornices, falling rocks from cliffs, and open creek trenches, steep avalanche gullies. Where necessary to cross dangerous spots, select route to cross at safest spot and hurry so as to remain as briefly as possible in danger zone.

In the woods, follow ridges or valleys, but valleys are bad unless creeks are snowed under. Avoid steep side hill because small gullies to cross and difficulty avoiding trees.

Planning a Trip

Select first the object, keeping in mind time of year, expected type of snow, strength and size of party.

Study the three types of maps - locate all possible routes, shelters, parking spots for cars and main landmarks. Lay out possible main base lines - imaginary lines connecting two peaks, or a large stream valley.

Find spot for closest help in case of emergency.

Inquire of others who have made the trip. Find out approximate

Planning a Trip (continued)

time involved, best possible trail, approximate time to reach starting point and good ski areas.
The knowledge of somebody else's mistake may make your trip successful.

The Trip Uphill

Check all equipment before starting.
Establish base lines and take compass bearings. Take bearings, if possible, on points that will be visible the whole trip.
See if the route you had planned is the most feasible one now that you are on the land.
Have at least two maps in the party and have them along with the compass easily accessible.
Keep the party together both for safety and for sociability.
The pace should be the fastest of the slowest member. Members known to be weak or slow should not be allowed to go on tough trips.
The leader should occasionally order "men or women forward".
Plan trip down on way up so that you will have the maximum skiing pleasure. In poor visibility, plan to return following your upward tracks.
In heavy snow use "ring-around-the-rosie" method of trail breaking.
Advantages of this method:
(1) Every member takes a fair share of trail breaking.
(2) No one gets tired because he only breaks trail for 20 or 30 steps.
(3) The party is able to travel faster.
(4) The weaker members can travel in the rear and miss the hard and tiresome work of trail breaking.
Do not be ashamed to take off skis at a bad or dangerous spot. Orient yourself at frequent intervals. This applies to the whole party as well as the leader because each member should know how the trail lies. Turn back if conditions look dangerous. It might not only be dangerous for you but also for the party which has to look for you.
Unknown territory in bad weather is not recommended.
At no time should one ski alone.

The Trip Downhill

The success of the trip may depend upon the leader's ability to keep the party together despite different skiing speeds.
The party should be kept together both for safety and sociability.
All the better members should be put in the rear guard with a captain appointed.
The rear guard should ski together and not pass up any of the rest of the party.
The leader downhill should be a good route finder but preferably not a first class skier.
About every half mile the leader should stop and count noses. In fog or storm, he should do this more often and also count the rear guard.

The Trip Downhill (continued)

An exception to keeping the party together is backtracking on a clear day when the party may split up into twos or threes each going its own pace. Even under these conditions, the rear guard must stay behind.

The advantages of this method:

- (1) The members of the rear guard are happy because they are skiing with skiers of equal ability.
- (2) The slower skiers are not unhappy, scared or rushed because of being behind.
- (3) The strong skiers are in the rear and in case of accident to the party, they will arrive without being chased.
- (4) The party has more fun and can watch the good skiers ski.
- (5) The party travels down just as fast as its slowest skier, hence it gets down just as fast anyway.
- (6) The members of the rear guard get more skiing in at the higher levels where the snow is better.
- (7) No one gets lost.

The route and trip should be planned for the members' pleasure because ski mountaineering is skiing for pleasure.

Questions

1. Any blooming idiot can ski in the mountains. True or False
 2. You can find the altitude of any point by using a contour map. T or F
 3. An aneroid barometer tells the time. T or F
 4. One can find a good ski trail from a contour map. T or F
 5. Contour lines close together means that the land is flat. T or F
 6. The compass needle points 23° E. of N. T or F
 7. To box a compass means enclosing the compass in a specially designed box which will compensate for the magnetic declination, T or F
 8. The declination of the compass is its act of refusing to be accurate. T or F
 9. When the contour on a contour map is in a small circle it indicates either a high or low point. How can one tell which it is?
-
10. Which is generally the easiest skiing? Mark one.
 1. Ridge running.
 2. Side-Hill gouging.
 3. Valley pounding.
 11. Which of the above three methods is usually the safest?
 12. A river valley could be defined as a base line. T or F
 13. Which is the easier skiing - uphill or downhill ? (underline)
 14. Which edge of a map is usually true north? _____
 15. An aneroid barometer is a handy gadget on a ski tour because with it: (mark one)
 1. One can measure the steepness of slope
 2. Tell the time
 3. Predict the weather
 4. Verify one's location
 16. A party is caught in a sudden snow storm above timberline. What should one do? (mark one)
 1. Head for the nearest telephone
 2. Eat lunch
 3. Follow tracks back
 4. Continue trip
 5. Follow radio beam
 17. Party returning to camp in new territory wishes to avoid tiresome climb over pass by taking a short cut. Which of the following would you do? (mark one)
 1. Keep going down as long as the base camp was below you.
 2. Take a lower pass and then ski to camp.
 3. Forget all about other plans and return over former tracks
 4. Take an airplane to camp.

18. In the spring of the year, because it is certain to be sunny and clear, you would leave your compass and map at home due to the added weight. T or F
19. On a ski mountaineering trip, the last one down is a niggerbaby.
t or F
20. On awaking at your 4000 ft. elevation camp and finding it misty, you would do which of the following? (mark one)
- Abandon your trip because it is bound to be misty at 10,000 ft. and you might lose your way coming down.
 - rub your eyes hard and see if the mist disappears.
 - Climp up, following your map and compass, hoping to get above the mist but turning back in ample time to get out of the mountains in daylight.
 - Forget about the whole thing and go back to sleep.
21. The party is inexperienced and in poor condition. On a bright sunny day it should make a difficult and dangerous climb just to show the good skiers that they can take it. T or F
22. A party of 40 wishes to make a 5000 ft. ascent. How should they proceed. (mark one)
- Have the leader break trail and the whole party follow him immediately.
 - Split the party up into pairs with each pair making a different ascent so that they can really explore the mountain.
 - Split the party into two or three groups with skiers of same approximate ability in separate groups with all following the general line of the leaders group ascent.
 - Every man for himself with a prize for the first one up.
23. The leader should always take ~~just~~ those who from past experience he knows are able to take the trip. T or F
24. Given skiers a,a,a, and b,b,b, and c,c,c, with "a" skiers first class, "b" skiers average, and "c" skiers weak, how should the party proceed up hill?
First _____ Last
25. How should the above party proceed down hill?
First _____ Last
26. All ski tours should be on Mt. Shuksan because when you get hungry there is a Baker nearby. T or F

III CAMPING

"The More in the Head the Less on the Back"

This section of the Ski Mountaineering course is devoted to winter camping, that is, camping on snow under conditions typical of winter in this region. It is the objective of this lesson to inform the skier as to the equipment essential to this phase of the sport and to provide instruction in its use.

The skier who sets out for an overnite stay in our winter hills will be concerned primarily with two things- Food and Shelter. For purposes of classification these two topics can be broken down as follows.

Food- Food and drink
Cooking equipment
Cooking fires
Cookery

Shelter-Packs
Sleeping equipment
Tents
Misc. shelters
Warming fires
Misc. equipment and notes

For purposes of instruction however, it appears more useful to approach the subject of Food and Shelter from the viewpoint of the skier who actually undertakes a trip. We will therefore set up two new headings, namely,

1. What to take
2. How to use it

1. What to take
- | | |
|-----------------------|------------------------------|
| a. Sleeping equipment | d. Cooking equipment |
| b. Tent | e. Axe |
| c. Food | f. And a pack to carry it in |

- a. Sleeping equipment
Essential

Sleeping bag-

Down if you can afford it. Wool for second choice. No others practical.

Bag tapered at foot will save weight.

Must be long enough to cover shoulders but "shorties" should cut down bag to suit.

Drawstring at top helps to keep out drafts.

Hood with drawstring or snaps keeps out drafts and protects ears, etc.

One piece bag is lightest but separate cover has advantages.

Double tube construction is best.

Double sleeping bags are warmer and lighter than two separate bags.

Can use a lighter bag in a good tent.

Desirable

Mattress- Preference in this order

- | | |
|---|------------|
| (1) Air rings (invalids) | (5) Cork |
| (2) Air pillow | (6) Paper |
| (3) Air mattress($\frac{3}{4}$ length) | (7) Boughs |
| (4) Sponge rubber | |

Boughs alone are adequate, and all of first six varieties are better with a foundation of boughs.

Take some string along to tie tube on air pillow(2) if you have "Dime Store" variety.
Sponge or foam rubber(4) hard to get and bulky to pack.
Cork(5) should be in pack size squares glued to cloth backing.
Paper(6) is the corrugated kind used for packing.

Miscellaneous

Newspapers- Are almost as good as a blanket when placed under you inside sleeping bag cover.
Bag lining- If your blood is extra thin take along an inner bag made of a light weight wool blanket.
Scarf- A long, wide wool knitted scarf to wrap around your middle will help.
Nightcap- A wool nightcap or knitted helmet is mighty comfy.

b. Tent

Best tents are as follows-

Sierra
Moade
Zipper
Appalachian
Misc. and tarps

Must be absolutely waterproof as it is impossible to avoid rubbing roof. A wet tent is heavier than a waterproof tent. Must be snowproof. If snow cannot be kept out you are as bad off as tho the roof leaked.

Must have a floor to keep wind out. Guy ropes must be arranged to anchor tent thoroughly.

Use rubber bands in main guys to prevent damage to tent.

Must be fireproof to permit use of Primus inside tent.

Floor should be cheap fabric and not waterproof.

Zippers must be rustless material.

Must have ventilators to reduce condensation when cooking.

Should be big enough for occupants and all gear, plus room to cook

Don't carry tent poles- use skis, ski poles, ice axes, etc.

(see sketches of tents)

c. Food

Cooking is definitely a part of the fun of camping but don't overdo it.

Selection

Choose food by the amount necessary and the distance it must be carried.

Food requirements can be divided generally as follows-

- (1) Trail lunches
- (2) Over nite trips
- (3) Long trips

(1) Trail lunches.

Nobody ever starved to death in one day.

Anything goes, take what you like.

Take foods which will stay moist.

Some things freeze readily or lose their taste when cold.

Chocolate gets dry and crumbly. Oranges freeze easily.

Whole wheat bread dries out rapidly. Try fruit and nut breads instead.

Peanut butter is dry stuff to swallow. Jelly and jam aren't much good in cold weather.

Take plenty of candy and sweet stuff- it is the only part of your lunch that provides any energy that day.

Water is scarce in winter- carry fruit juice or a canteen.

A thermos bottle of hot coffee, tea, soup, etc., is worth taking.

Take a lemon for addition to drinking water.

Use plenty of butter in sandwiches.

Carry gum and fruit drops.

A mixture of raisins and nuts are good for munching along the way.

A trail lunch for a second day can be taken from home but it must be made up of 'squirrel food' as sandwiches and similar fresh stuff will not keep palatable.

(2) Overnite trips

A typical overnite trip includes the following meals-

Dinner- 1st nite

Breakfast- 2nd day

Trail lunch- 2nd day

Perhaps trail lunch 1st day and lunch at car 2nd evening.

Note that this schedule calls for only one major meal to be cooked in camp.

Breakfast ordinarily requires very little cooking.

A one dish dinner is recommended.

Try cooking this at home and reheating in camp.

Use 'dry' foods instead of 'dehydrated'.

Dehydrated fruits and vegetables will not cook in time for Sat. nite meal.

Try cooking vegetables at home and reheating in camp.

Write out a menu and take it along.

Ham and bacon are usable in many ways. Try various sausages for a change.

If the distance is not too great it is possible to carry all fresh or 'wet' foods.

(3) Long trips.

On trips involving two or more nights out, it is imperative to use dry and dehydrated foods. Care must be used to include some fruits and fresh food, as severe digestive troubles can develop in the course of several days if the diet is not reasonably balanced. Bread cannot be carried so recourse must be had to pan breads or to making biscuits from Bisquick, etc.

d. Cooking equipment

Kettles- aluminum best, tin ok- get three nested

Frying pan- army or Scout type

Cup- tin, enamel-or plastic- no handle or open type

Spoon- desert size

Knife- steel camp type

Fork- not essential

Plate- Use top of frying pan or use paper plates

Salt and pepper shakers- closeable type or old spice cans

Misc.- couple of pieces of wire for pot hooks, paper napkins for all purposes, small piece of soap and rags for washing and drying dishes.

e. Axe

Pocket axe- rather small for cutting logs

Hatchet- about same as above but heavier

Camp axe- best all-around tool