

ICE

Alpine Ice Climbing Course 2024



[Mt Hood/ Sandy Headwall]

Course Overview

- Alpine Ice Lecture
 - Mon, Aug 5
- Field Trips (Mt Baker Lower Coleman Seracs)
 - Sat/ Sun, Sept 7-8
 - Sat/ Sun, Sept 14-15
 - Sat/ Sun, Sept 21-22

[Mt Baker/ Coleman Glacier – Lower Seracs]

Alpine Ice

- Variety of forms under combined effects of pressure, heat, frozen precipitation, time, snow, etc. into alpine ice of glaciers, ice fields, and couloirs.
- Little distinction between alpine ice and hard snow.

[Mt Hood/ Leuthold Couloir]

Water Ice

- Liquid **water** freezes to form water ice.
- Dramatic as waterfalls, thin as clear coating over rock surfaces.
- Water ice usually harder, steeper, and more brittle than alpine ice.

[Ouray Ice Park, CO]

Characteristics of Ice



[Mt Rainier/ Kautz Glacier]

Characteristics of Ice

Ice Quality = Weather

- Ice formed directly from water freezing; or indirectly through metamorphosis of neve (permanent snow).
Ice is distinguished from hard snow when its mass is airtight.
- **OPAQUENESS** denotes softness.
Soft, plastic snow can lead to good tool placements; too soft and weak can lead to weak protection.
- **COLOR** indicate hardness.
Blue ice (ice relatively pure) vs black ice (old, hard ice mixed with dirt, pebbles, debris)
- **CLARITY** equals brittleness.
Can require extra time to plant a tool without ice shatter.
- Cracks and fractures can mean weakness
- “Dinner plates” mean temperatures are changing (tends to happen later in day as air warms), surface of ice becomes softer and more aerated, breaks away in plates

Mitigating Hazards

A photograph of a rugged mountain peak, likely Fissile Peak, showing a mix of dark, jagged rock and patches of snow. The sky is overcast and grey. The foreground shows more rocky terrain with some snow.

[Fissile Peak/ Northwest Face, British Columbia]

Objective Hazards

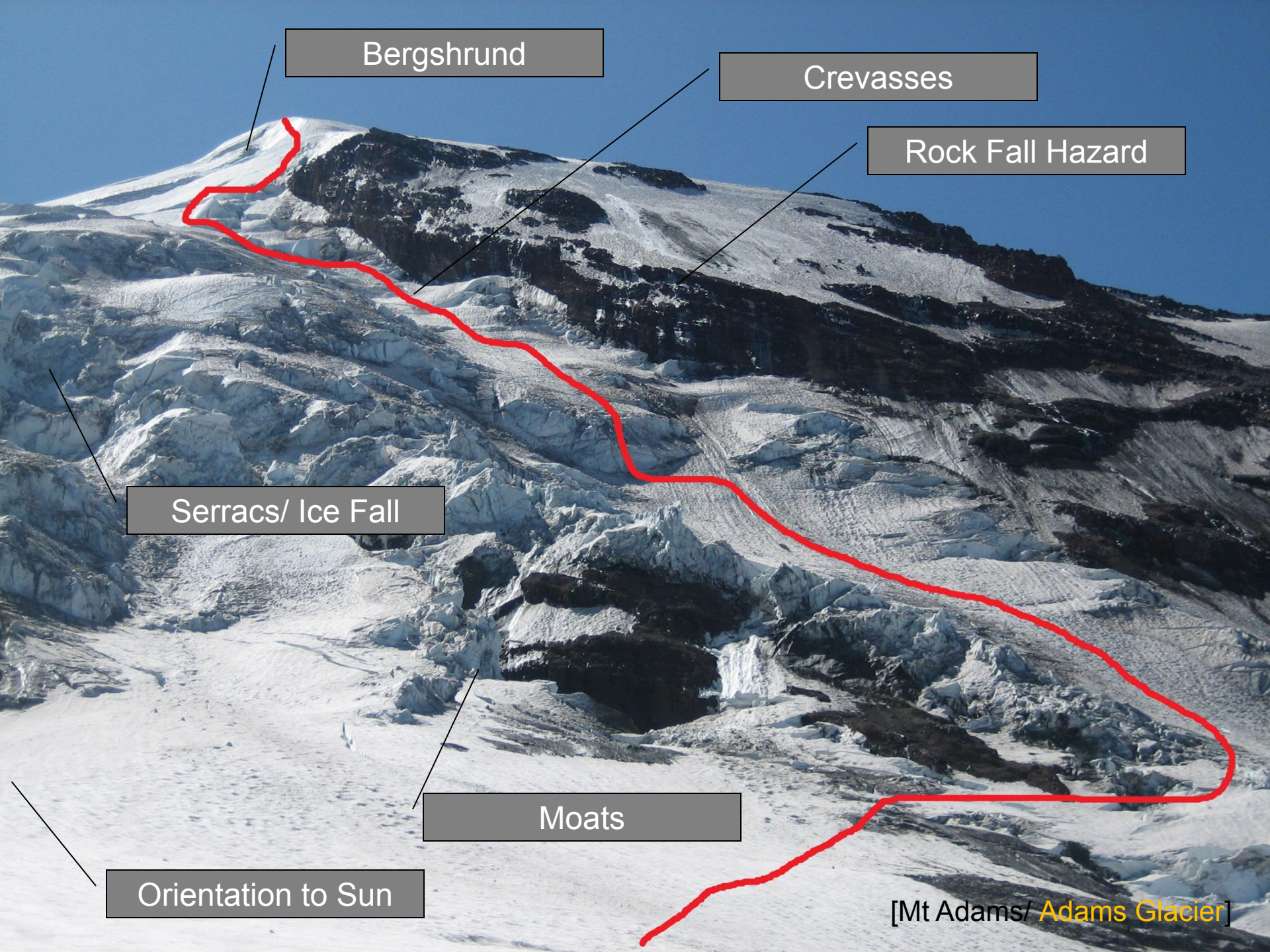
- Loose rock, hidden ice, crevasses on approach
- Falling ice and rock
- Avalanche/ weather conditions
- Ice quality

[Mt Rainier/ Liberty Ridge – July 17, 2010]

Hazards You Control

- Loose clothing
- Inappropriately racked gear
- Sharpness of tools and crampons
- Poor crampon & travel technique
- Fatigue
- Slips/ falls
- Timing of attempt

[Mt Adams/ Lyman Glacier]



Bergshrund

Crevasses

Rock Fall Hazard

Serracs/ Ice Fall

Moats

Orientation to Sun

[Mt Adams/ Adams Glacier]

Condition Factors

- Cold/ warm temps
- Cloud cover
- Aspect; when the sun lights up a slope
- Storm cycles
- Avalanche conditions
- Timing of the trip

[Mt Buckner/ North Face]

Safety and Speed



- Speed/ efficiency is safety
- Time is against you
- Ice trips have limited forgiveness of error, strong potential for injury
- Route finding is important
- Know when to turn back

[Johannesburg Mountain/ Cascade-Johannesburg Couloir]

Efficiency

- Desire to move faster
- Stay fit
- Know the weather
- Memorize ascent/ descent routes
- Early starts absorb contingencies
- Adopt a steady pace
- Let the strongest lead all the way through, or block lead
- “Draft” by hooking leader’s pick holes, to save time & energy
- Eat & drink frequently to save energy- carry warm drinks instead of brewing up
- Carry light packs and be strict about contents
- Don’t place screws too high to interfere with your next tool placement
- The best way to deal with getting pumped, is not to get pumped

Efficiency

- Arrange packs with most useful stuff on top
- Use longer ropes
- Avoid complicated gear
- Use chocks and natural protection; use bollards instead of deadmen and ice pitons
- Use longer axe- axe/ second tool combo is good for alpine ice
- Cut steps instead of putting on crampons in short sections
- Learn to put on crampons on fast
- Keep tools **SHARP**
- Crampon quickly across dangerous areas- crab across with both tools deployed in *piolet panne*
- Your ice tool is also a nut tool
- Carry the hex key you need to tighten your pick
- Use ice features for foot placements when possible

Efficiency

- If really pressed for time, follow on tension using nothing but hands, or use the rope as handline
- Don't drive in axe for self belay when following in steps; use balance instead
- Avoid cutting long ladders of steps
- Don't use piolet traction if axe only will do; use hands instead of tools where possible
- Swing the second tool with the lead; swing the belay jacket with the belayer
- Stop and belay only if necessary; **avoid rope of three**
- Know the snow conditions and travel on stable wind pack
- Down climb when possible; rappel only when necessary
- "Chicken clip" to place a screw if you are in an unsettled position
- Face outward when descending whenever possible. Face inward as last resort

Gear



Necessary Clothing + Gear

- Warm, fitted clothing
- Sunscreen, Sunglasses
- Climbing helmet
- Stiff mountaineering boots (leather, plastic, hybrid)

Advantages/ disadvantages to each

- Gators
- Climbing harness
- Single & double runners with carabiners
- Cordelette
- Standard glacier travel gear
- 10 essentials

CE Safety Certifications

Comité Européen de Normalisation

- B (Basic) - General Mountaineering Axe
Generally lighter & less durable
NOT strong enough for technical climbing
- T (Technical) – Technical Ice Axes & Ice/ Mixed Tools
Picks and shafts are rated separately
Not uncommon to have CE-T shafts with CE-B picks
CE-T picks are thicker and better suited for mixed routes



Ice Climbing Hardware

- **SHARP** 12-point crampons w/ front points- compatible with your boots

NO ALUMINUM

Preferably with anti-bot plates

- Ice axe (60+cm)
Verify pick will stick in the ice
- Second ice tool with hammer (55cm)
- Leashes (spinner, hand, runner)
- Tool protection (*keep things sharp*)
- Ice screws, variety of lengths (eg- 19, 22 cm and smaller)
- Pickets
- V thread tool

Ice Climbing Hardware

Optional (but nice to have)

- Tool holster
- Load limiting protection
- Helmet visor or goggles
- Waterproof gloves, or multiple pairs of gloves
- Quick draw
- Trekking poles
- Rap ring & extra perlon
- Pitons and/ or Rock Pro (*for mixed climbs*)

Tool & Crampon Maintenance



[Mt Rainier/ Mowich Face]

Sharpening Tools and Crampons

Better kicks and sticks!

- Sharp equipment and tight bolts — picks, head weights, etc. — should be part of your pre-flight check.

Always carry the necessary hex key(s) to tighten your tools.

- Sharp points moving fast enter the ice more easily and disturb it less, saving you energy and preserving the medium.

Swan dive versus belly flop.

More important for water ice than for glacial ice.

- Everything that touches the ice should be sharp, i.e., at least tool picks, primary front points, and secondary front points.

Sharpening Tools and Crampons

Shaping by subtracting material.

- For tools and crampons, use a “mill bastard file”. Readily [available](#) from Amazon.
- The goal is to make the pick and front points into the shape you want.
 - **Do not** use a bench grinder. It will heat up the metal.
 - Gently clamp the pick in a vice or brace the tool against your leg. *Be careful of furniture and flesh.*
 - First, shape the cross-section of the tip to match the shape when it was new. (E.g., if it gets “beaked” from hitting rock...)
 - Next, shape the edge with smooth, even strokes in the same direction on each side.
- Sharpening removes metal, so think about that as you work.

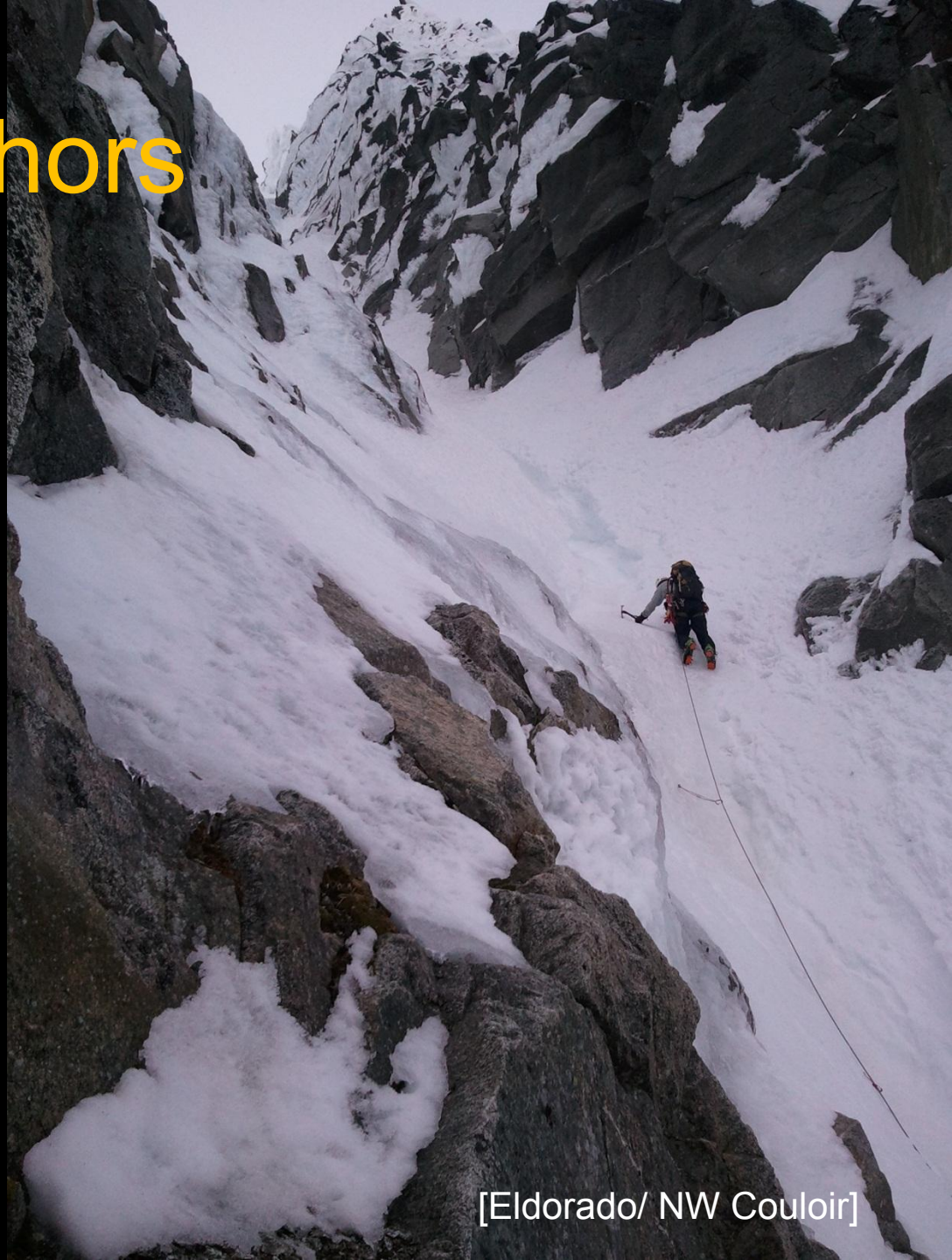
E.g., don’t sharpen the front side of your secondary front points, as that will alter the profile of your crampons.

Sharpening Tools and Crampons

Be gentle with your screws.

- Sharpening screws is an involved process that requires skill, care, and additional kinds of files.
- The best way to keep your screws sharp is to not dull them. Keep your screws capped when not in use and be careful around rock.
- Video about sharpening tools and crampons:
<https://www.youtube.com/watch?v=TelFz1cSdQU>
- Video about sharpening ice screws:
<https://www.youtube.com/watch?v=L-CQbOM35oY>

Common Anchors



[Eldorado/ NW Couloir]

Common Anchors

- Ice Screws
- Pickets
- Pitons (Mixed Routes)



Belay Anchor

- Three Ice Screws
 - Placed staggard*
- Equalized Cordellette
- Belay Follower off Anchor

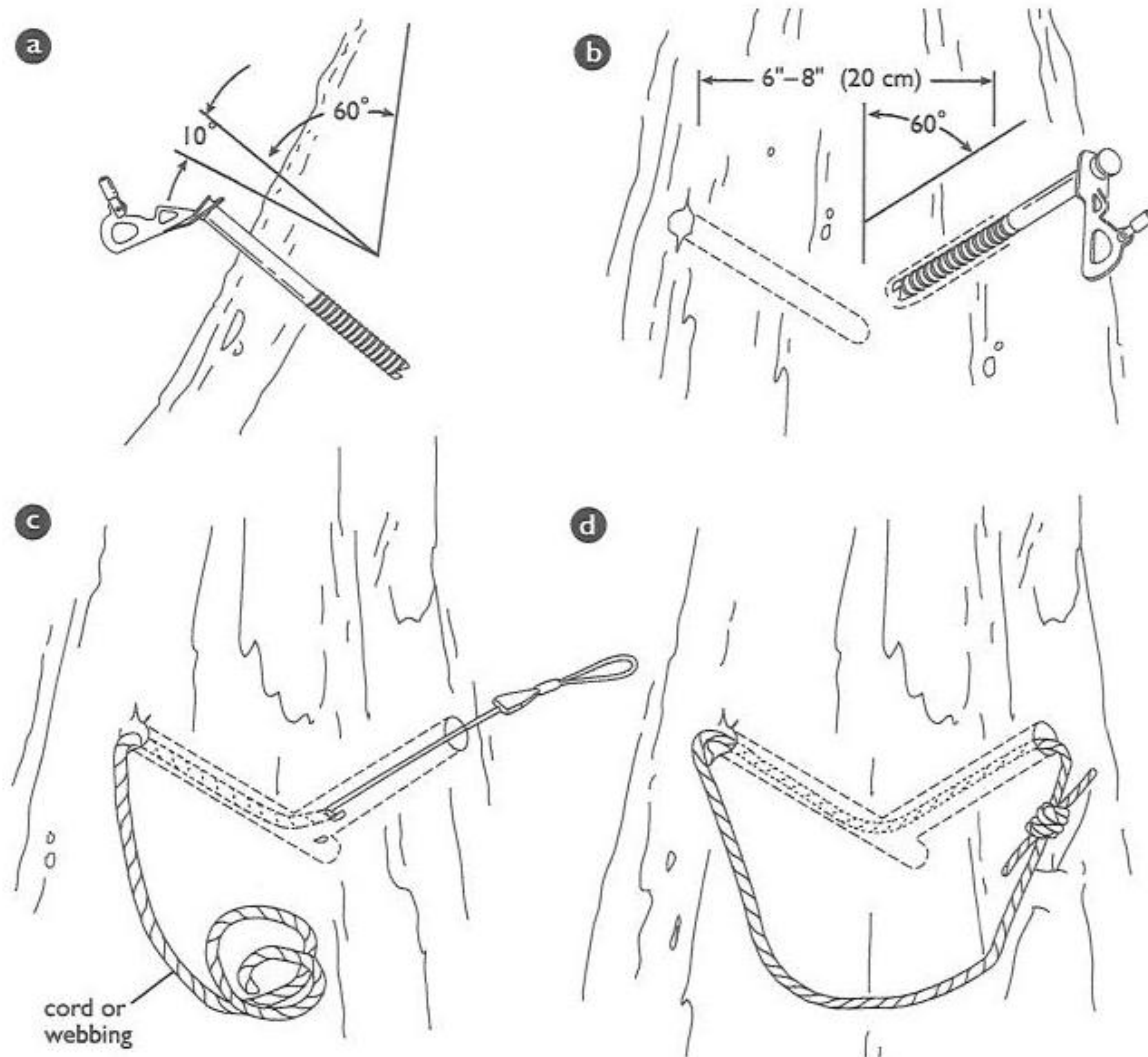


Common Anchors

- Abakalov / V-threads
- Ice bollards



Making a V-Thread Anchor



Ice Screw Top-Rope Anchor

- Two Ice Screws
Placed staggered
- Equalized Runner
Extend as necessary
- Use Locking Carabiners
- Place Snow atop Ice Screws
*To mitigate screw melt-out over time, **not shown for clarity***

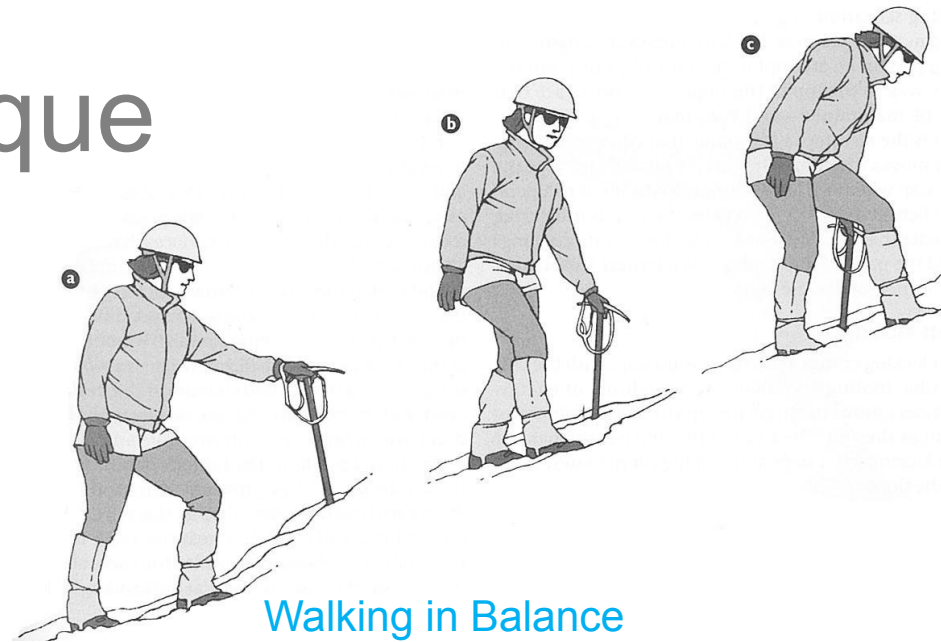


Climbing Technique



[Mt Baker/ North Ridge]

Low Angle Technique



Ascent- cane position

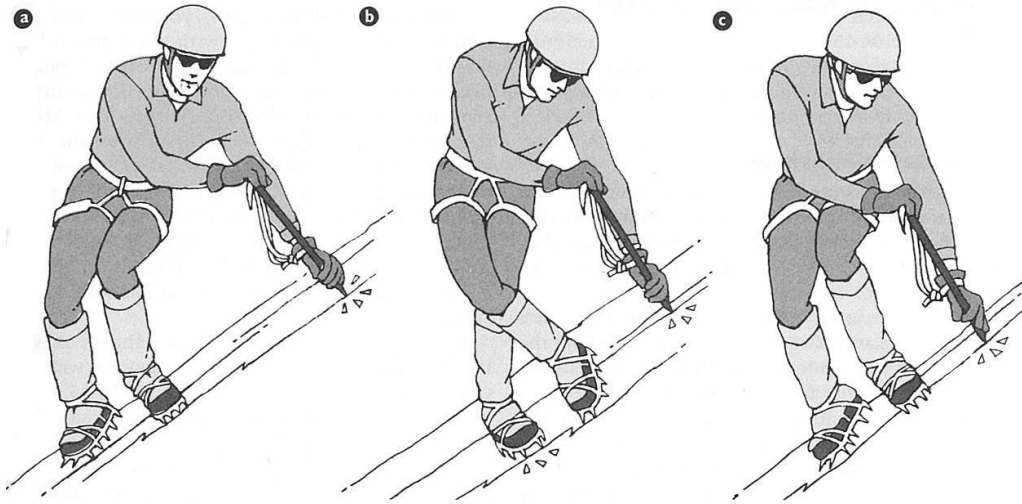


Ascent- stake position

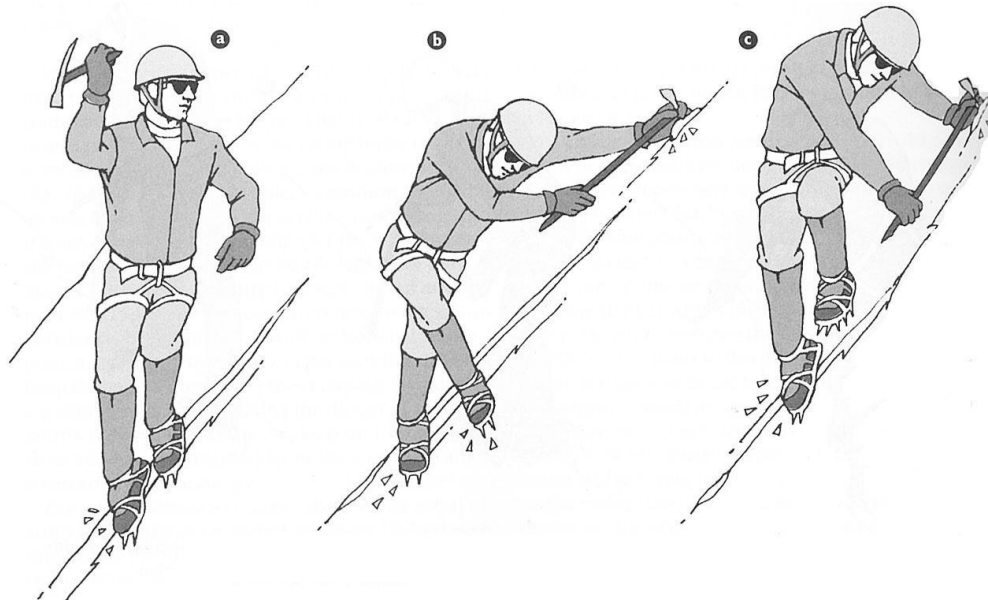


Ascent- Ax in horizontal position

Moderate/ Steep Angle Technique

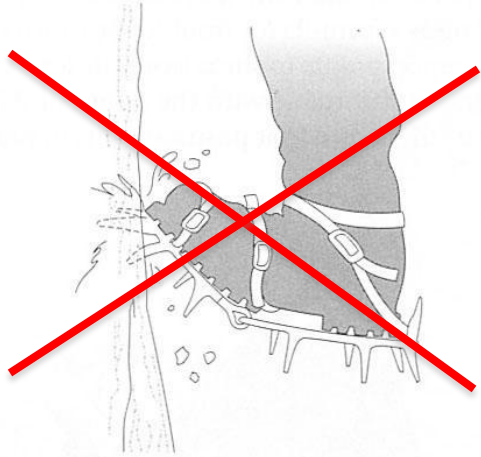


French Technique/ Ax in
Cross- Body Position



French Technique/ Ax in
Anchor Position

Front-pointing

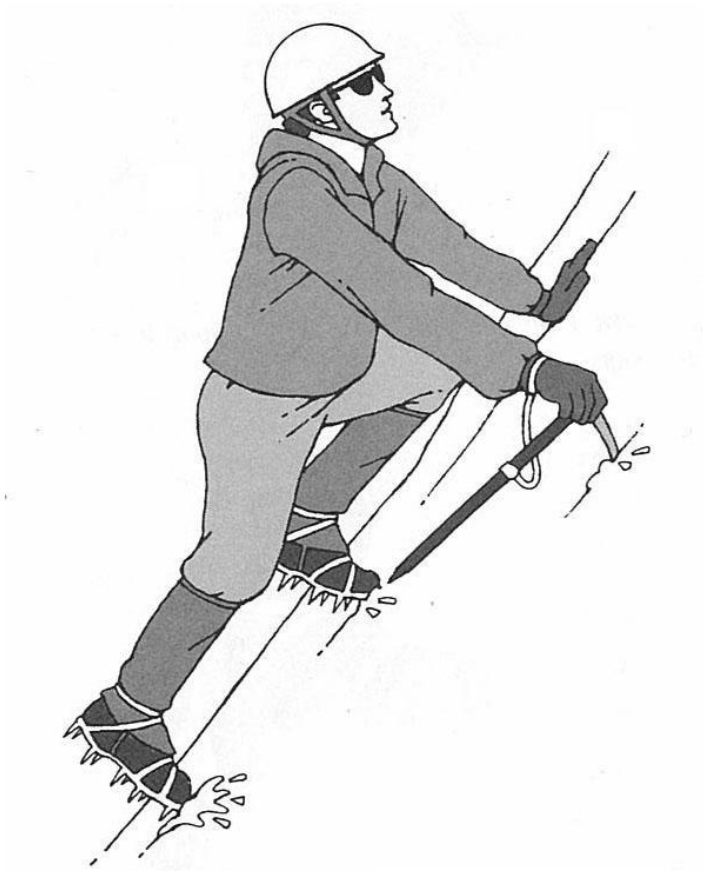


NOT CORRECT



Correct

Ax Position- High/ Low Dagger

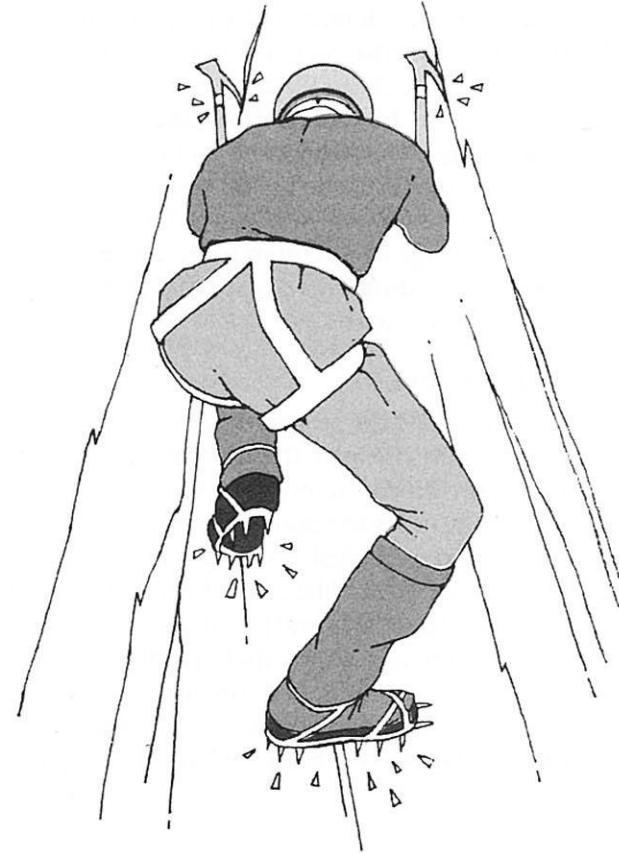


Front-pointing/ Ax in low
dagger position



Front-pointing/ Ax in high
dagger position

Ax Position- Traction



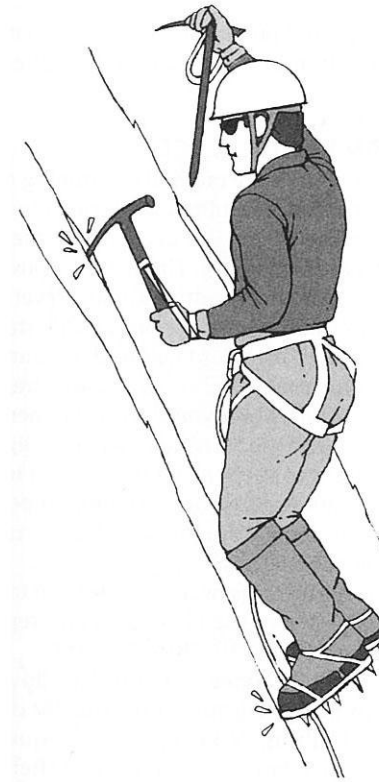
Front-pointing/ Ax in overhead traction

Three-O'Clock position/ Ax in overhead traction

Ax Position- High/ Low Dagger

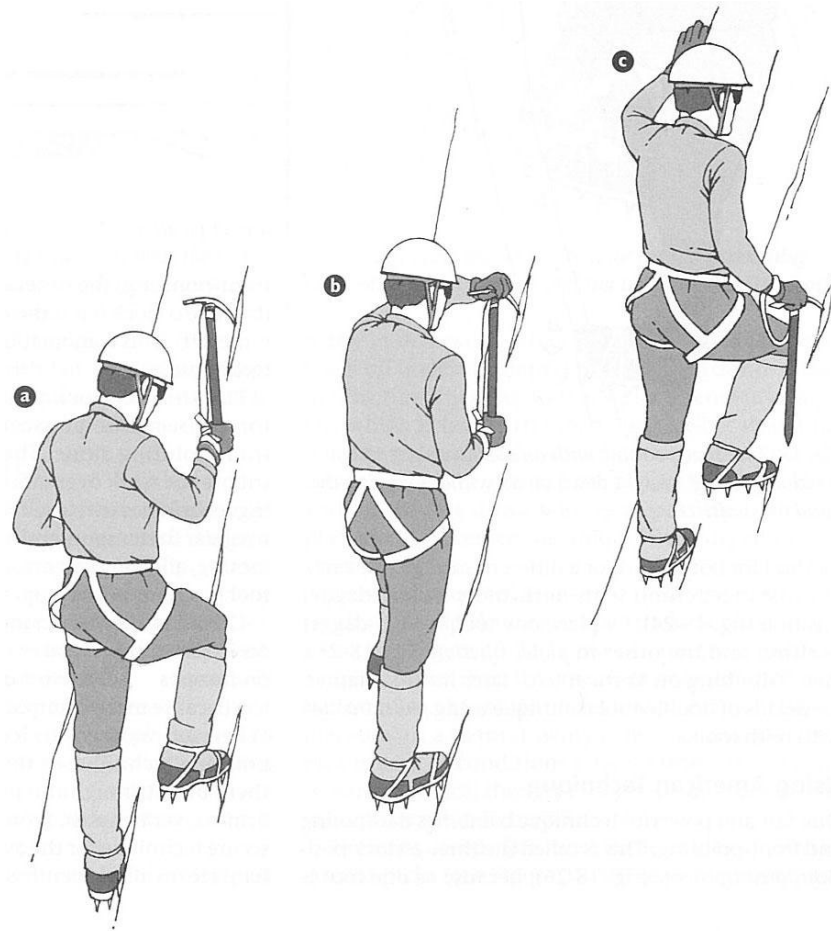


Front-pointing/ Ax in low dagger position



Front-pointing/ left Ax using traction with right Ax in high dagger position

Ax Position- High/ Low Dagger



Front-pointing/ Moving with Ax in High
and Low Dagger Position

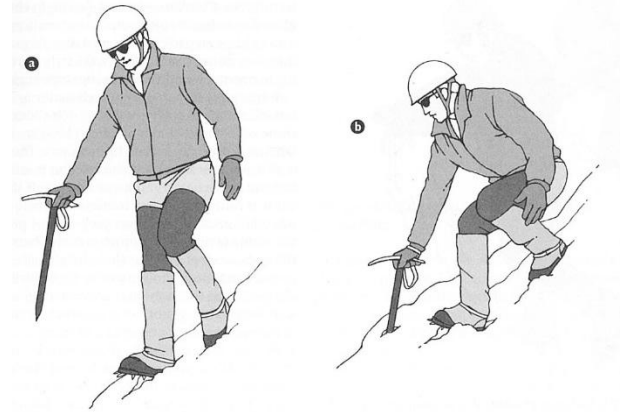
Descending



Flatfoot/ Ax in cane position



Flatfoot/ Ax in cross-body position



Plunge stepping

Movement on Ice



[Observation Rock/ North Face]

Prior to the Ice Climb

- Know your route, what to expect for the desired climbing day
- Know the recent weather history & forecast, including avalanche forecast if applicable
- Review team composition, party size
- Perform tool maintenance & sharpening as necessary
- Establish a Climbing Plan

While Ice Climbing...

- Assess route & weather when you arrive

Is it what you expected?

- Go/ No-Go Decision prior to starting
- Use proper footwork
- Climb in balance, move efficiently
- Use proper tool work

Relaxed swing, when to employ techniques for efficiency, avoid overdriving tools

- Properly carry and stow tools as conditions permit
- Use safe travel technique across ice falls, moats, bergshrunds, crevasses
- Running belays/ simul-climbing **vs** Swinging Leads
- **MAKE INFORMED DECISIONS**

Questions



[Mt Rainier/ Liberty Ridge]