



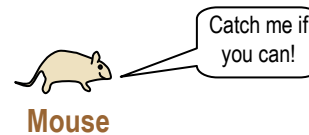
Will Durness

Knot Basics

A knot is a *bond* formed by tying a rope to itself, to another rope, or to an object.

Knots are used by nearly everyone (e.g., tying shoes) and in special situations by many groups including campers, truckers, sailors, and climbers.

Tying knots can be tricky. A slight variation here or there can render a knot useless or in danger of slipping. And it's not always obvious which knot to use for a given situation.



To learn some knots, we'll follow the friendly but not too bright *SnakeEye* (rope) as he's led into a series of turns by his clever buddy *Mouse*.

For other knots, *SnakeEye* may play with another snake or an object. And sometimes, he'll simply contort his body to show off his flexibility.

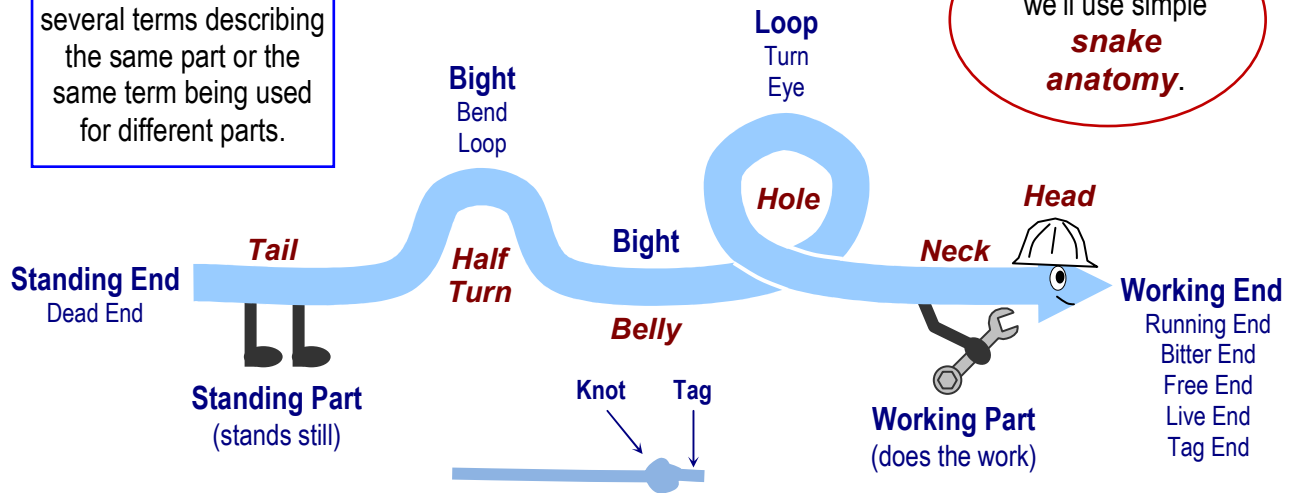
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Rope Terminology

Rope terminology can be confusing with several terms describing the same part or the same term being used for different parts.

To avoid confusion, we'll use simple **snake anatomy**.



Elements / Categories

Elements form knots. Categories help us decide which knots to use when.

Knot Categories

[SHL-JB : shil-job]

Elements

[Th-Th-W]

1. **Turns**

2. **Holes**

3. **Twists**

4. **Hitches**

5. **Wraps**

1. Stoppers

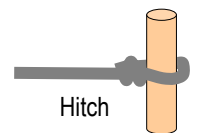
Purpose: Stop rope from slipping through something.
Examples: Overhand, Multifold Overhand, Figure 8.



Stopper

2. Hitches

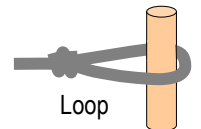
Purpose: Attach rope *tightly* to something. (hitch tight)
Examples: Half, Clove, Cow, Tautline, Timber.



Hitch

3. Loops

Purpose: Attach rope *loosely* to something. (loop loose)
Examples: Bowline, Double-Loop Bowline, Butterfly.



Loop

4. Joiners

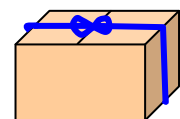
Purpose: Join ropes together. [Rope term: Bend]
Examples: Sheet Bend, True Lovers, Splice.



Joiner

5. Binders

Purpose: Bind things together.
Examples: Square, Constrictor, Whipping, Lashing.

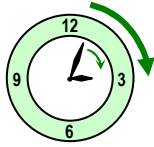


Binder

Turns

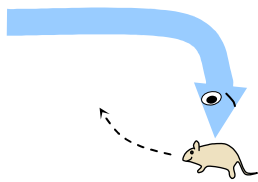
SnakeEye *turns* to pursue the elusive Mouse.

To Do
Get some rope
and match
SnakeEye's path
as he chases
Mouse.

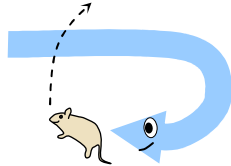


Clockwise (CW) Turns

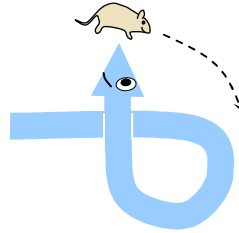
Coming from left



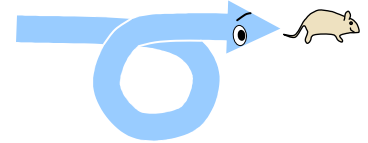
1/4 Turn (90°)



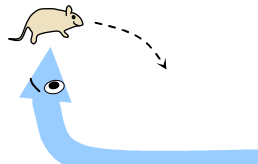
Half Turn (180°)



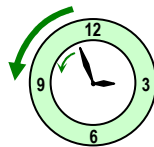
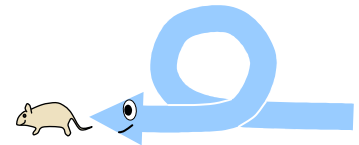
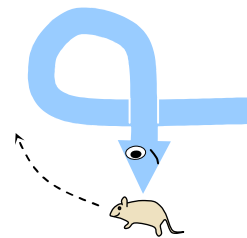
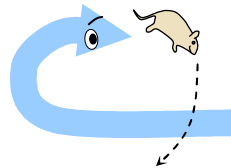
3/4 Turn (270°)



Whole Turn (360°)

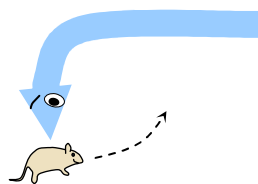


Coming from right

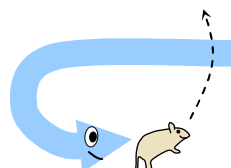


Counterclockwise (CCW) Turns

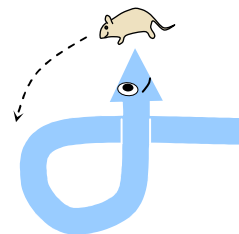
Coming from right



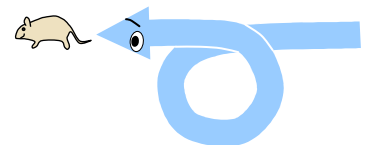
1/4 Turn (90°)



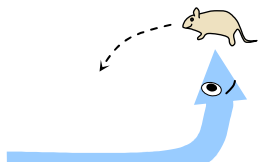
Half Turn (180°)



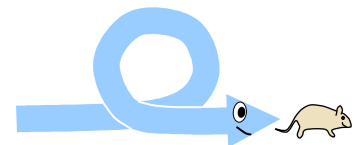
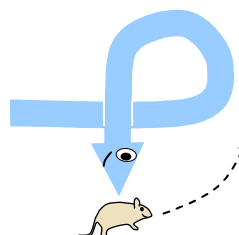
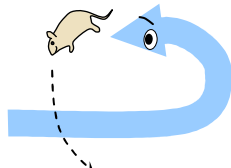
3/4 Turn (270°)



Whole Turn (360°)



Coming from left

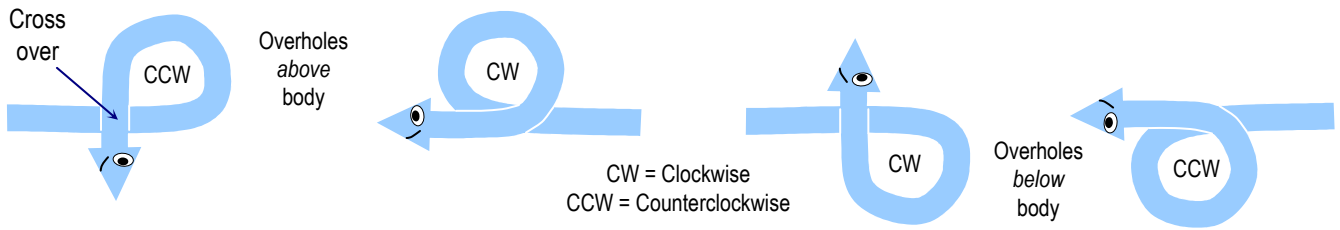


Holes

SnakeEye makes $3/4$ or *whole turns* across his body.

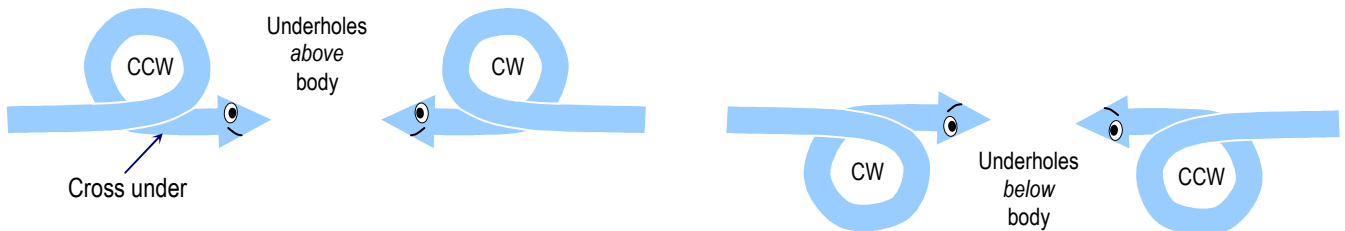
Overholes

Head crosses *over* body [Rope term: Overhand loop]



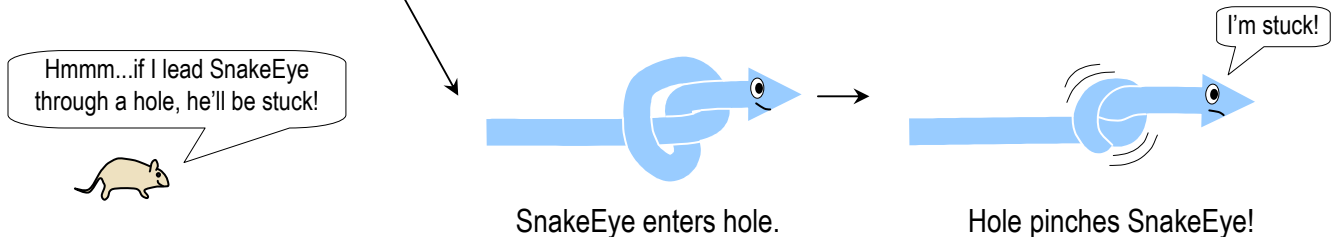
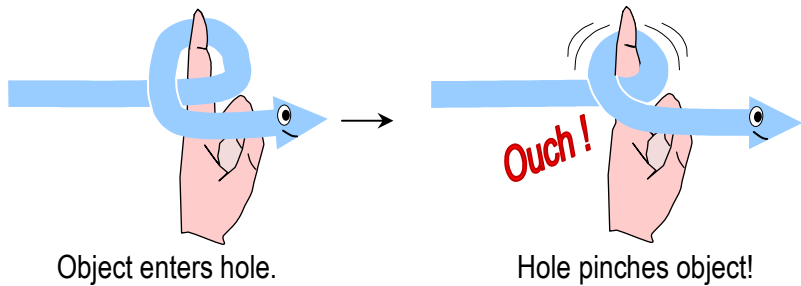
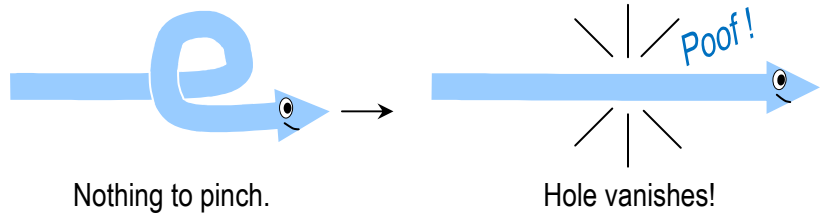
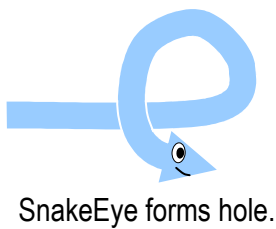
Underholes

Head crosses *under* body [Rope term: Underhand loop]



Pinching Holes

To make most knots, holes must have something to "pinch," either an object or the rope itself.



Hmmm...if I lead SnakeEye through a hole, he'll be stuck!



Twists

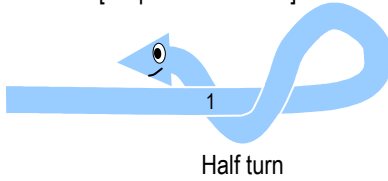
SnakeEye makes *loose half turns* around his body.

Outside Twists

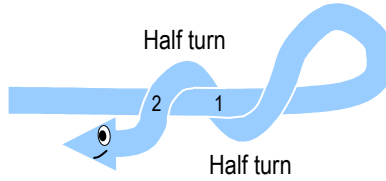
Away from hole

Single Twist

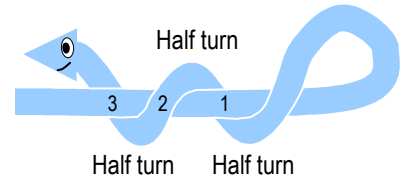
[Rope term: Elbow]



Double Twist

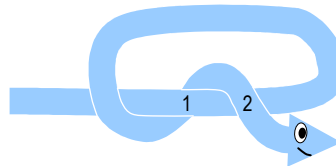
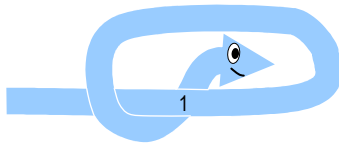


Triple Twist



Inside Twists

Into hole



Hitches

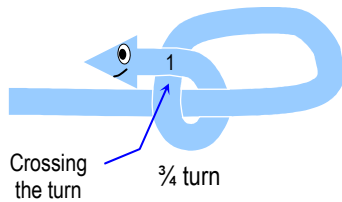
SnakeEye makes a *3/4 turn* around his body then crosses the turn.

Outer Hitches

Out of and away from hole

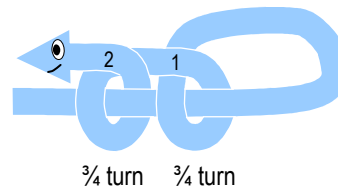
Single Hitch

[Rope term: Half hitch]



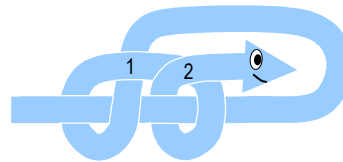
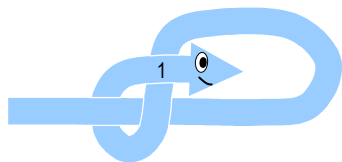
Double Hitch

[Rope term: Double Half hitch]



Inner Hitches

Into hole



Observe that hitches make **HOLE**s around SnakeEye's body.

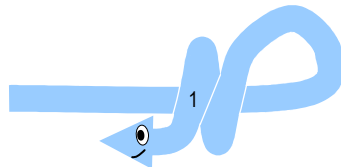
Wraps

SnakeEye makes *tight whole turns* around his body.

Outside Wraps

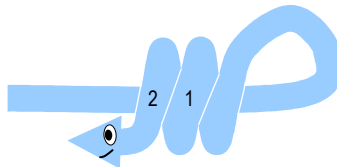
Away from hole

Single Wrap



Whole turn

Double Wrap



2 Whole turns

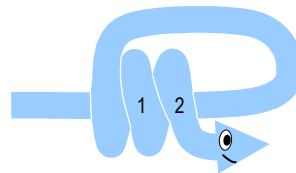
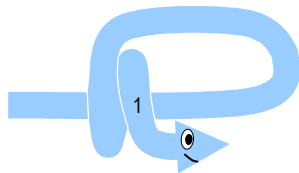
Triple Wrap



3 Whole turns

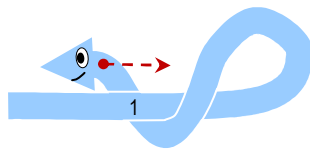
Inside Wraps

Into hole

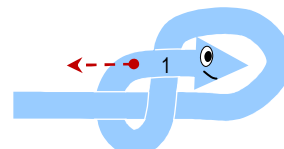


Transformations

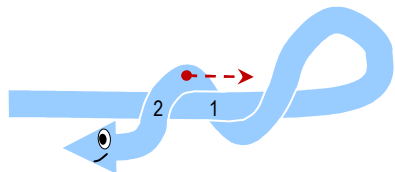
Twists, hitches, and wraps can be transformed into each other.



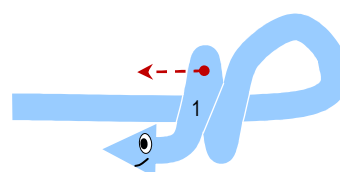
Bringing a **Twist** back on itself makes a **Hitch**



Undoing a **Hitch** makes a **Twist**



Pushing a **Double Twist** together makes a **Single Wrap**

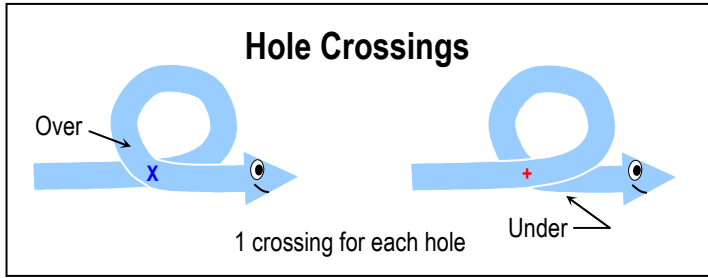


Undoing a **Single Wrap** makes a **Double Twist**

Crossings

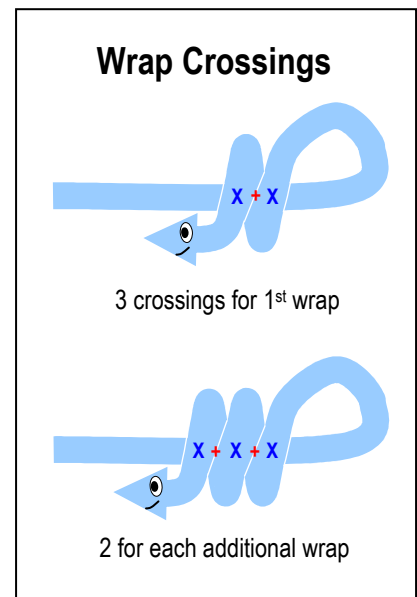
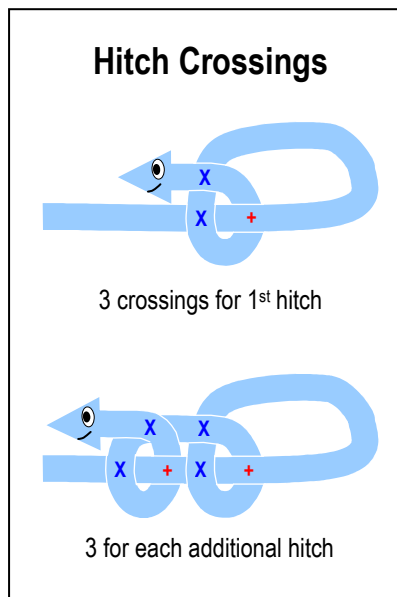
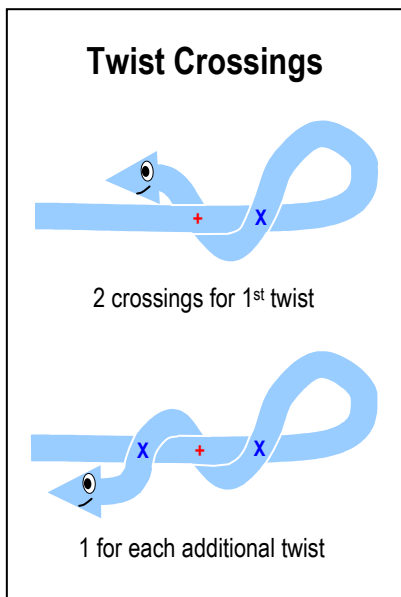
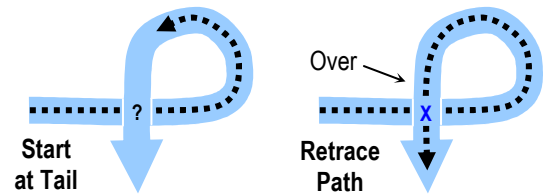
SnakeEye crosses his body or an object.

X = Cross Over + = Cross under

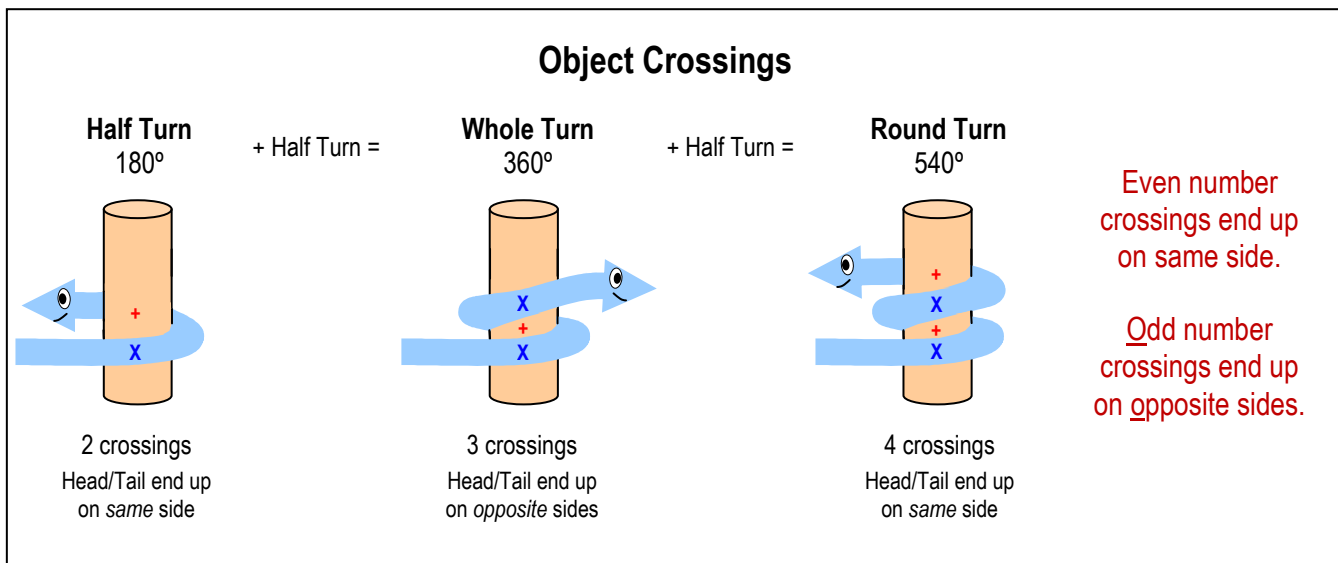


Over or Under?

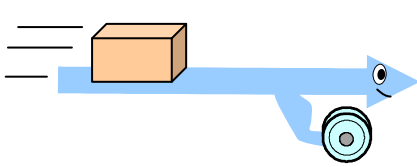
To tell if a crossing is over or under, mentally retrace SnakeEye's path starting from his TAIL.



X = Cross Over + = Cross under

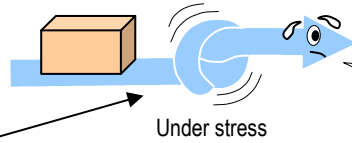


Knot Strength



I'm at full strength pulling this load!

A straight rope has 100% strength because all its fibers are lined up and bear a load equally. However, putting a knot in a rope can reduce its strength by as much as 50%.



I'm feeling a bit weak.

Every crossing produces a point of contact where friction can occur. This can lead to failure when the knot is under a fluctuating load, for example, a boat tied to a dock as the tide ebbs and flows.

Dressing A Knot



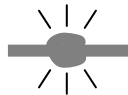
Undressed

To maximize the strength of a knot and prevent it from coming unraveled or binding improperly, it's important to "dress" or align its parts to minimize stress and friction.



Dressed

Jamming & Capsizing



Knots that have a tendency to tighten or "jam" under load or when wet can be very difficult to untie.



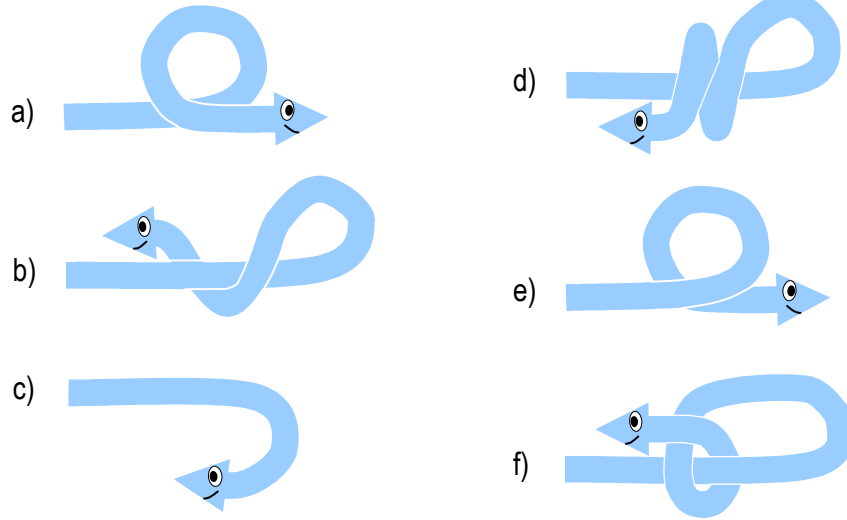
Knots that unravel or "capsize" under load are dangerous. Some knots can be purposely capsized to untie them.

Your Turn



Match each knot shape with its picture.

- 1) ___ Half Turn
- 2) ___ Overhole
- 3) ___ Underhole
- 4) ___ Twist
- 5) ___ Hitch
- 6) ___ Wrap

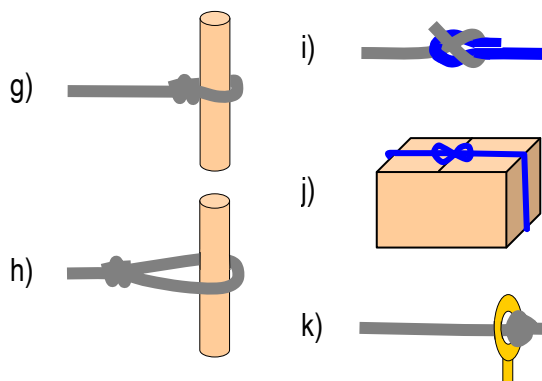


True or False

- 7) _____ To decide if a Crossing is over or under, retrace the path from the *tail*.
- 8) _____ In a Whole Turn (3 crossings), the head and tail end up on the *same* side.
- 9) _____ Hitches also form holes around the rope body.
- 10) _____ Knots add strength to a rope.

Match each knot category with its picture.

- 11) ___ Stopper
- 12) ___ Hitch
- 13) ___ Loop
- 14) ___ Binder
- 15) ___ Joiner



Answers: 1c, 2a, 3e, 4b, 5f, 6d, 7T, 8F, 9T, 10F, 11k, 12g, 13h, 14j, 15i