Sharpening

with

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Handout accompanying demonstration at Woodworkers' Weekend

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A fast and effective sharpening sequence that I use:

Stone	Particle size (μm)	"Grit" (see below)	Purpose	Comments
Diamond	60	220	Flattening back, setting bevel	Repairing chipped or damaged edge*
Diamond	45	325	Flattening back, setting bevel	Repairing mildly damaged edge
Waterstone	11	1200	Sharpening dull edge	Similar results for 800, 1000 or 1200 grit
Waterstone	2	6000	Honing	Similar results for 6000-8000. Stop here for chopping.
Polishing Board	0.5		Final polishing ("stropping")	Noticeable improvement for paring and planing

*For severely damaged edge start with 120 grit (corresponds to 120 μm) abrasive on glass or mdf, or go to grinding wheel.

Some useful conversions:

1 micron (micrometer) designated as 1 μm = 0.001 mm

1 μm = 0.000039 in.

25.4 μm = 0.001 in., i.e., a "mil" or thousandth of an inch

“Grit” is a four-letter word:

- Particle size of abrasive is key physical measure affecting sharpening.
- Stones and abrasives are more often sold according to grit, which introduces confusion.
- For sharpening chisels and plane blades, the blades in roughest shape need to begin at 60 μm to 120 μm or larger particle size. For planing or paring it is best to continue through abrasive of about 1 μm or less.
- For blades that are dull but not damaged start with waterstone of 16 to 11 μm (800, 1000 or 1200 grit). These three give more or less equivalent results.
- “Grit” corresponds to particle size only within a given system of nomenclature
- There are many systems--North American, European, Japanese, Russian,… The grit numbers in these systems are defined based on the average particle size, the min. and max. limits, and fraction of particles allowed outside the size range.
- For grits above about 240, there are differences among the various systems
- For *approximate* conversions among North American, European and Japanese systems see the table below, which I have compiled from various sources

CAMI (North American)	FEPA (European)	JIS (Japanese)	**Particle size μm (micron)**
120	P120		120
220	P240	240	60
325	P320	325	45
400	P600	600	23
600	P1200	800	16
800	P2000	1200	11
1000	P2500, F600	1500	9
1500	F1200	4000	3
1600	F1500	6000	2
1800	F2000	8000	1.2
2000			1
		> 10,000	0.5

Sharpening new chisels and plane blades:

- Flatten the back
  - Place the back of the blade on the stone and stroke full length of the stone
  - Start with the finest stone that will do the job quickly. I find that 325 grit diamond stone usually works well; sometimes can start with 800-1200 grit waterstone if back is already nearly flat
  - Backs of chisels need to be flattened for 2 inches or more past the cutting edge. Why? The back of the chisel serves to jig the cutting edge, where the back is guided along a surface for many paring and chopping operations
  - Backs of plane blades need to be flattened only near the cutting edge, say a minimum of 1/8 inch. Why? The plane jigs the cutting edge at an angle to the wood surface and does not rely on the back of the blade as a jig.
  - Flattening the back of a chisel can take a while

- Hone the back
  - With the back of the blade held flat on the stone, stroke back and forth. Progress to finer grits, finishing with a 6000-8000 grit waterstone

- Establish the bevel angle
  - Clamp the blade in the honing guide at the desired angle and with the length of the blade at 90 degrees to the axis of the guide roller. Recommended honing guides, in order of preference:
    - Veritas Mark II honing guide
    - Generic vise type guide with small roller
    - Finger grip technique for holding fixed angle
  - Generally sharpen primary bevel at 25 degrees. For chopping, for soft or very hard steels (Japanese chisels) a 30 to 35 degree bevel is more durable
  - Start with the finest stone that will do the job quickly. I find that 800-1200 grit waterstone usually works well; sometimes need to start with 325 grit diamond stone if bevel is rounded or otherwise distorted
  - Work on the bevel until it is uniform and you feel a definite burr on the back. The burr forms when the bevel and back intersect, a condition needed for getting a sharp edge. If there is no burr, then the bevel and back do not yet intersect
  - After 800-1200 grit stop working on the primary bevel

- Create and hone a microbevel
  - On Veritas honing guide, rotate roller cam from “up” position to “down” position. This will add 2 degrees or so to the bevel
  - On vise type honing guide, loosen clamp and pull blade back 1/8 inch (~ 3 mm). Retighten clamp.

- With finger grip technique you automatically get a microbevel when the primary bevel was ground on a wheel, i.e., hollow ground.
- Why a microbevel? When you sharpen the same blade next time the microbevel is all that needs to be worked. This will save time compared to honing the full length of the primary bevel.
- Stroke on the 800-1200 grit waterstone until the microbevel is uniform and extends back from the cutting edge about 1/16 inch or more
- Stroke on 6000-8000 grit stone until scratches from previous stone are removed
- When nearly finished on each stone let it get a little dry and lighten pressure; swarf gives a sharper edge than indicated by stone grit number
- Stroke back flat on same stone to remove small remaining burr

§ Final polishing or stropping
- Use a shop made "stone", being a board of maple or birch plywood with surface filled with 0.5 micron chromium oxide compound
- With blade still in honing guide stroke microbevel backwards away from the cutting edge say 3-5 times
- With back of blade flat on stropping board stroke several times to remove smallest scratches and microscopic burr

§ Testing for sharpness
- Shave hairs on the back of your hand
  - § Drawbacks: you may nick yourself; you will look like you have some kind of skin disease if you do a lot of woodworking.
- A safer method, but less personal
  - § Shave end grain on maple, cherry, or a softwood
  - § Look for low effort to push, a nice shaving and a glassy surface

Sharpening dull blades sharpened before:

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§ Don't need to flatten back, unless it has been damaged

§ Follow steps above for polishing the back as needed and for honing and polishing the microbevel

Some steels used in chisels, plane blades and turning tools:

AISI Designation	Elemental Composition (weight percent)								
	C	Mn	Si	Cr	Ni	V	W	Mo	Fe
O1	0.925	1.200	0.300	0.500		0.300	0.500		balance
A2	1.000	0.700	0.300	5.125		0.325		1.150	"
M2	0.830	0.275	0.325	4.125		1.850	6.400	5.000	"
M4	1.325	0.275	0.325	4.250	0.300*	4.125	5.875	4.875	"

* max