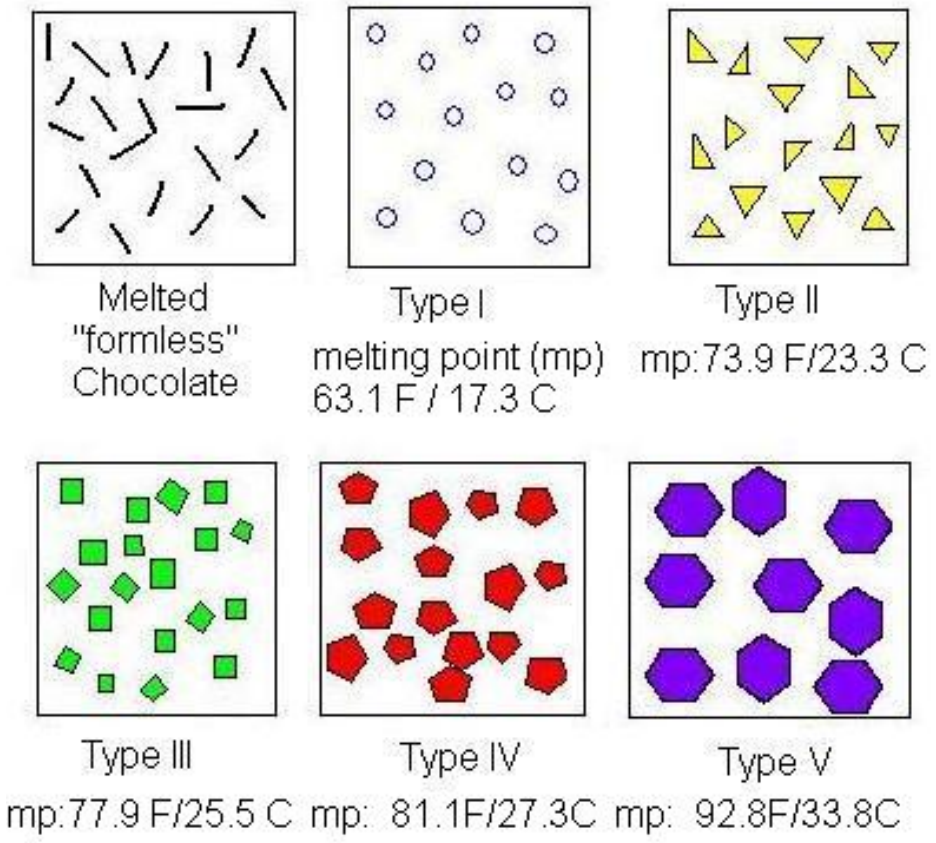
What does it mean to temper chocolate?

- Tempering chocolate prepares the correct crystal form of the cocoa butter, so that it is shiny, hard, and will last in that state for a long time.
- We must bring the chocolate through the correct temperature cycle to select the right crystal growth.

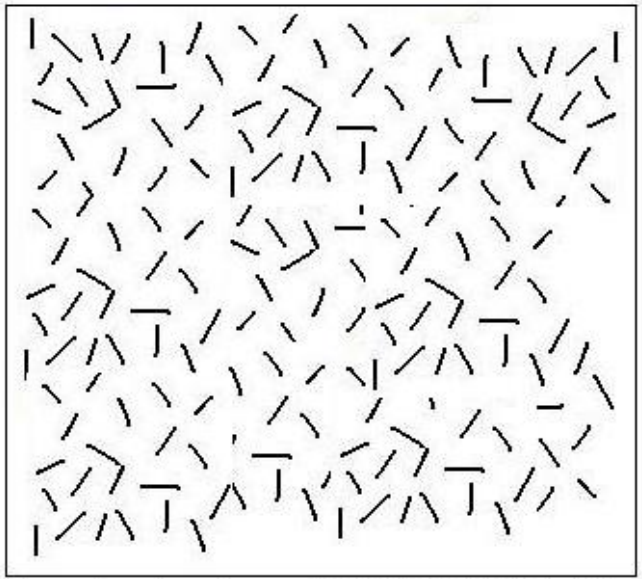
Crystal polymorphs of cocoa butter

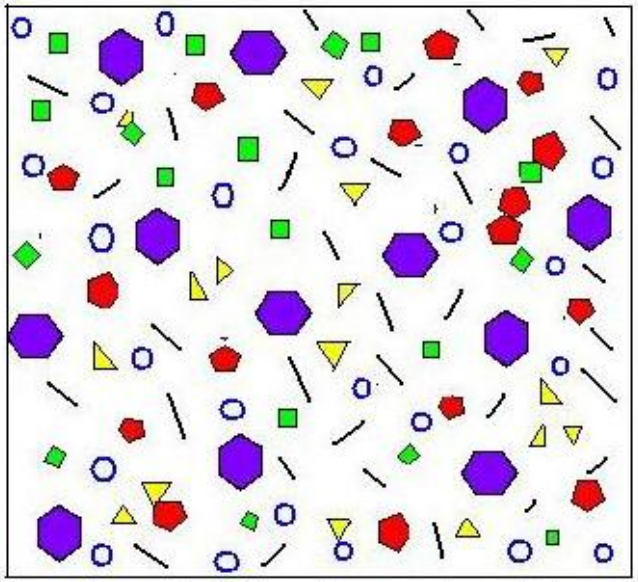
FORM	MELTING RANGE
Form I (beta - prime 2)	61° to 67° F
Form II (alpha)	70° to 72° F
Form III (mixed)	78° F
Form IV (beta-prime 1)	81° to 84° F
Form V (beta 2)	93° to 95° F
Form VI (beta 1)	97° F



http://chocolatealchemy.com/illustrated-tempering/

http://acselementsofchocolate.typepad.com/elements_of_chocolate/TEMPERINGCHOCOLATE.html

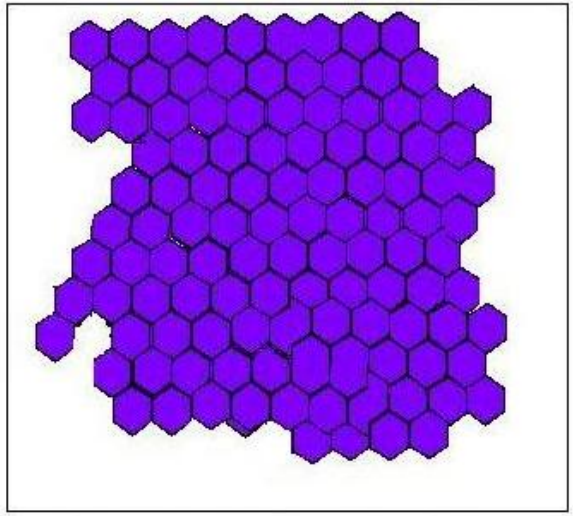




Rapidly cool to nucleate many crystal types

Heat until melted chocolate does not have any crystals

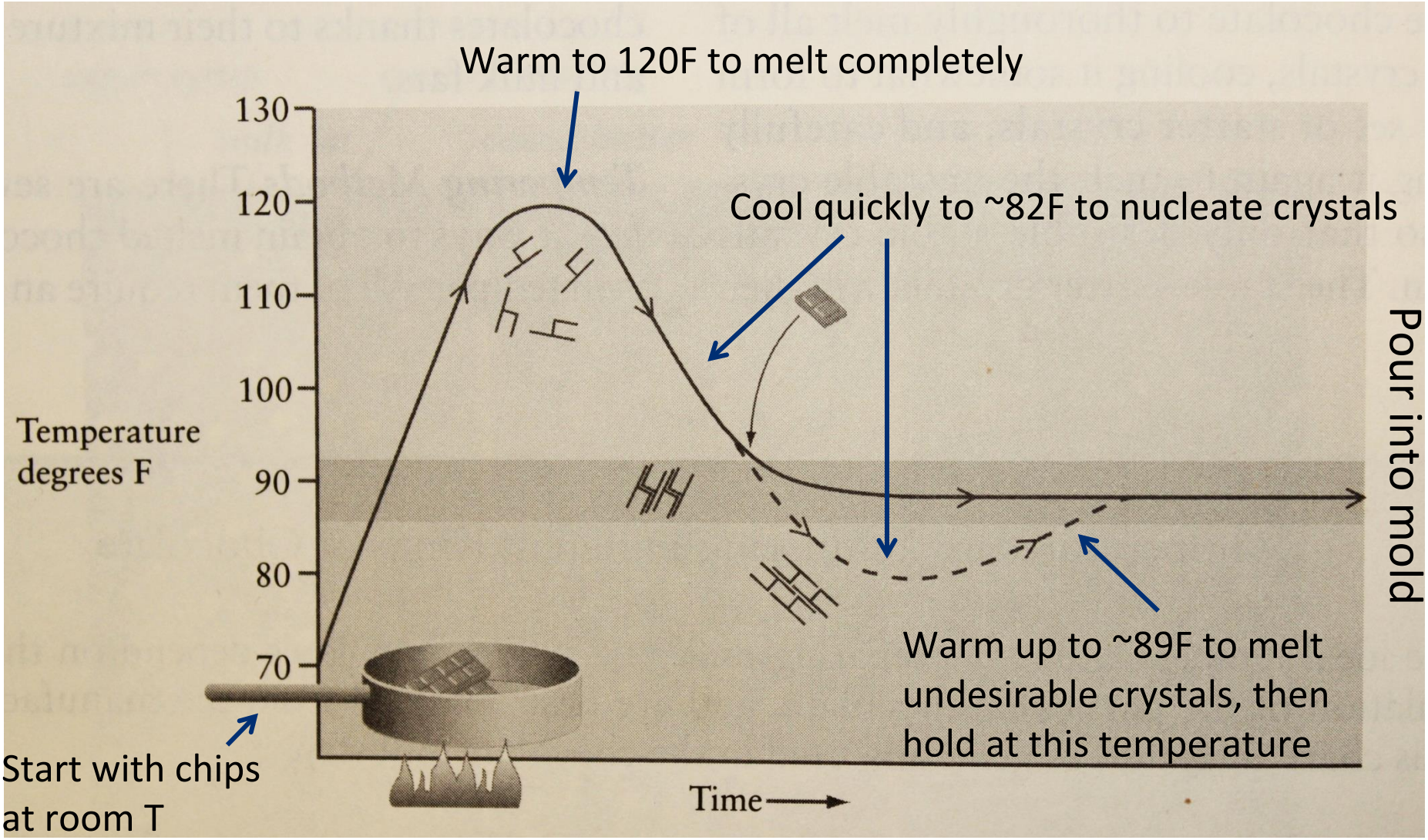
Our goal:



Hard, shiney Tempered chocolate

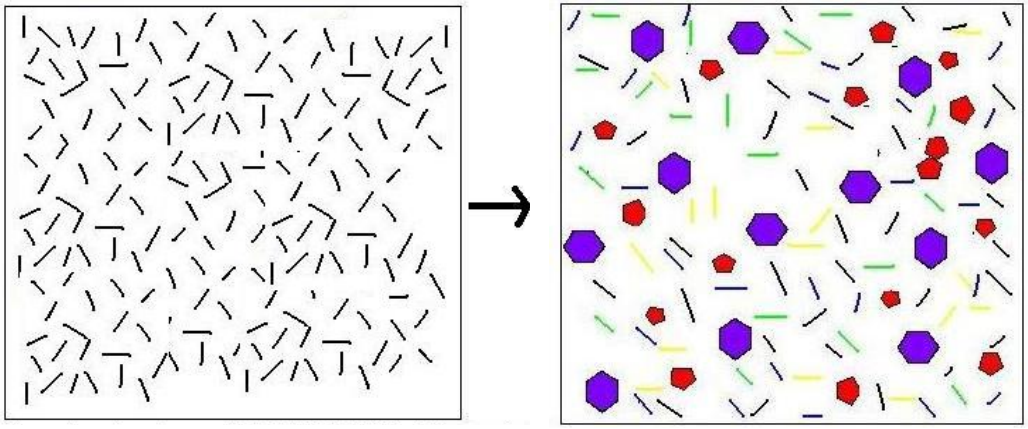
Melt the undesired crystals and allow growth of the desired crystals

Procedure

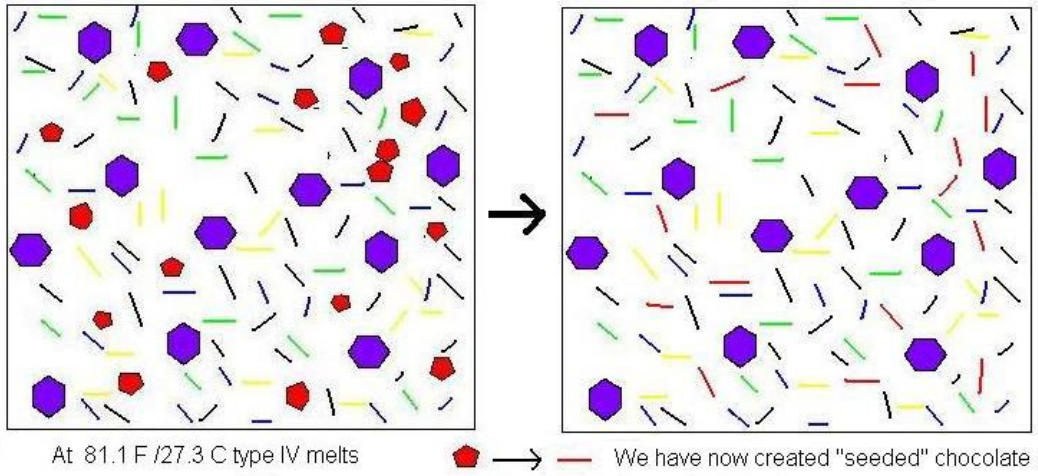


We will follow the method of the dotted line which doesn't use seed crystals.

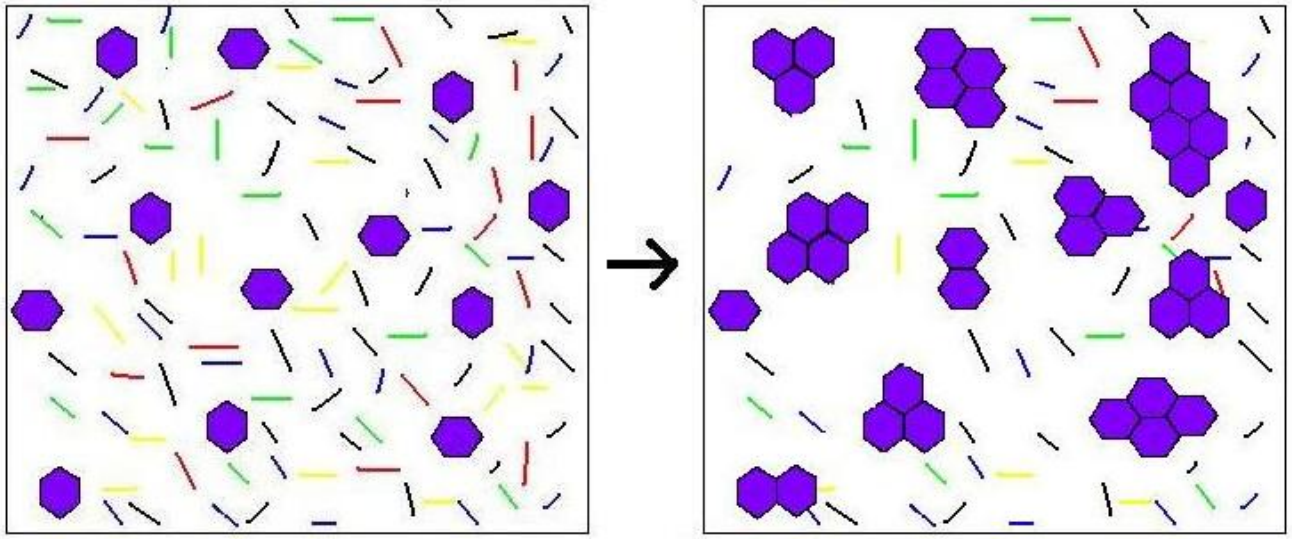
Strategy:



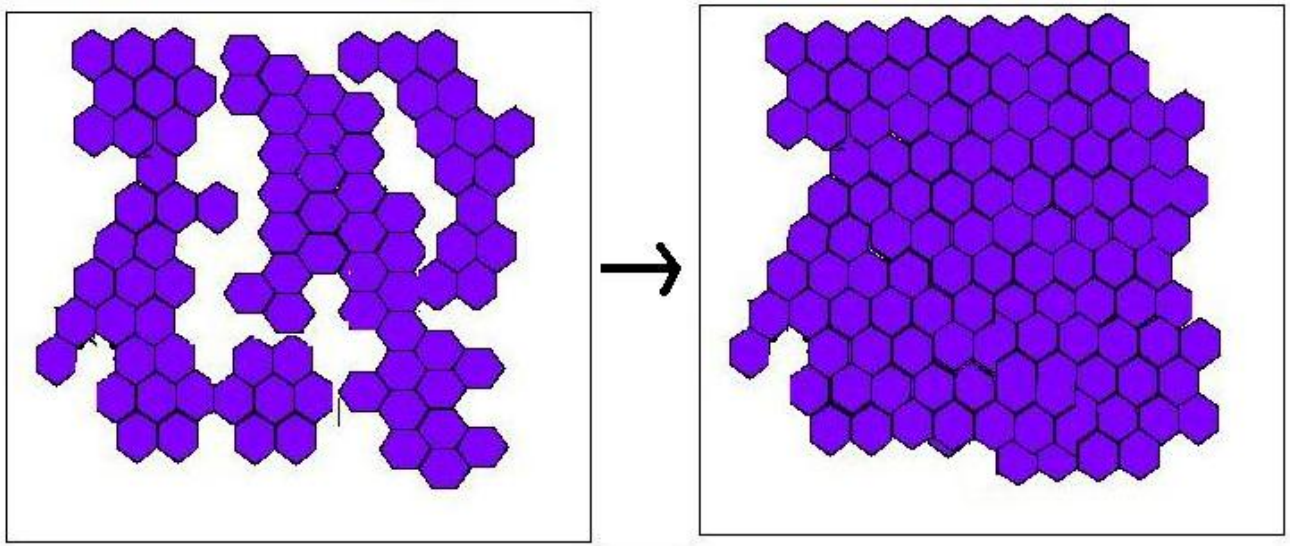
Cool quickly to ~80-82F to nucleate beta and beta prime crystals



Warm to ~88F to melt beta prime crystals, and let beta crystals coarsen



Now pour into mold:



Advice

- Mix continuously at all times to keep temperature uniform and move thermometer around (without touching pan) to get correct temperature reading
- Temperature changes occur slowly but beware of overshoots (particularly on final warming) Constantly raise and lower insert to control temperature.
- Water will cause chocolate to “seize” so keep water temperature below boiling and keep steam or droplets out of mix – keep electric burner set to low.
- Quick cool using ice bath, let some of the chocolate completely harden, and overshooting here seems okay.
- On warming back to 89F, pause for a few minutes at ~86F

- Do the Smear Test throughout

The Smear Test

- If correctly tempered, a smear of chocolate place on wax paper will harden in about three minutes.
- Before you fully melt your chocolate, try a smear test to see what it looks like.
- Do another at >100
- Test at 82, and again after you think you're finished to see if it worked.
- If it's not hardening, try rapidly cooling again, from 89F, and rewarming slowly.

The cheating method…

- We're making life difficult – you're starting with perfectly good tempered chocolate.
- If you can't get it working, it *will* work if you melt the chocolate without ever going above 90F.

- Use the smear test to prove it to yourself, and then make the molds!

Physics of Crystal Formation

- First order phase transitions (melting temperature, latent heat)
- Supercooling in absence of critical nucleus ("seed crystal") due to surface free energy cost versus volume free energy gain
- Polymorphs: metastable crystal forms that may coexist with stable crystal for some time, or even indefinitely if stable crystal is not nucleated (think "ice nine")
- Coarsening and growth below melting temperature; different growth rates for different polymorphs, growth inhibited by diffusion rate, heat transfer, etc.

Plan

- Divide into 6 stations of 3 people
- Spend 5 minutes sketching your design
- 1 person from group will go make the molds
- The remaining pair will make the chocolate
- Time permitting you may switch off roles for another batch

WASH YOUR HANDS!!