1. **EU definition of "wine"**	the product obtained exclusively from the total or partial alcoholic fermentation of fresh grapes, whether or not crushed, or of grape must
2. **Grape maturity**	One of the most decisive factors in determining wine quality and style Physiological changes - phenolics & taste Biochemical changes - sugars & acids
3. **Key questions for harvesting**	When Forecasting Preparing How (manual vs machine)
4. **Harvest date**	Grape ripeness - sugar - acid - health - phenolic ripeness Agrochemicals (fungicides, insecticides, herbicides, pesticides, etc) - withholding period - fermentation and health problems e.g. sulphur --> hydrogen sulphide copper --> brown haze, toxic copper salts in wine Weather - rain --> dilution, grape swelling and bursting - hail Availability of resources (human and mechanical) Legal restrictions
5. **Havesting - Getting ready**	Estimating the crop (sufficient tank space) Checking & cleaning equipment and machinery Tanks clean and ready for use Oenological products (yeasts, sulphur, enzymes, etc)
6. **Havesting - Machine vs Hand**	Factors to consider - quality - speed - economics - feasibility Machine - speed, grapes at peak; cheaper labour costs; cool night - damage, oxidation, no selection, cost of machinery, flat land, trellis system (no bush nor pergolas) Manual - less damage, more selectivity, slopes, less $ for equipment - high labour costs (10X machine), slower - for sparkling wine, carbonic maceration (whole bunches); Tokaji, Beerenauslese, Trockenbeerenauslese (selection of grapes); required by law

7.	**Havesting - Transport & Reception**	Use shallow picking containers Less transfer between containers Less dumping heights Refrigerated trucks Minimize delay before processing Oxidation - browning, loss of aroma - CO_2/nitrogen blanket; potassium metabisulphite; harvest at night; min delay Microbial growth - eliminate rotten grapes; clean equipment; berry integrity; min delay Contamination - rain - leaves & stalks - MOG (material other than grape) - soil
8.	**Key questions for grape processing**	Sorting De-stemming Crushing Type of press Amount of SO_2 Must treatments
9.	**Sorting in French**	Triage
10.	**De-stemming**	Tannin control and ease of processing Egrappoir = de-stemming machine Most grapes are de-stemmed Not for sparkling wines and carbonic maceration Not required for machine harvested grapes Pros - prevent release of phenolics, herbaceous flavours, MOG - more efficient pressing - remove water and potassium (absorb colour and alcohol) Cons - whites: slower pressing and drainage (not for fine wines) - reds: compaction of pomace cap; tannins and colour
11.	**Crushing**	Release free-run juice Reduce the solid parts of the grape to the correct condition for fermentation and maceration Increase extraction of tannin and colour Careful not to damage grape seeds Not to crush for semi-carbonic maceration (Spain, Beaujolais, Languedoc-Roussillon for Carignan and Grenache) Fouloir = crusher Equipment - foot or de-stem/crush - heat exchanger - SO_2 to reduce oxidation and prevent microbial spoilage - use of pectolytic enzymes to release more juice

12.	**Pressing**	Use of minimum pressure Done at grape reception for whites; after fermentation for reds 70% of the total weight Skin contact for aromatic whites (Sauvignon Blanc, Semillon, Muscat, Riesling, Gewuztraminer, Viognier) - 5-10 C - few to 24 hours - pectolytic enzyme Finest aromatic wines - very gentle whole-bunch pressing - no skin contact
13.	**Types of press**	Vertical screw press (basket press) - simple and easy; clear must or wine - slow, labour intensive; extraction of bitter phenolics; oxidation - high-class wineries; champagne Horizontal screw press (e.g. Vaslin) - more efficeint in terms of time and labour; simple; can be automated; prevent oxidation with inert gases - rather coarse juice; extraction of bitter phenolics; high pressure reduces quality Pneumatic press (e.v. Willmes) - low pressure; good extraction; less bitter phenolics; high quality juice - very slow Tank press (pneumatic press with inert gas) - no oxygen contact; high quality juice - very slow; costly Continuous screw press - high throughput; less labour-intensive and time consuming - poor quality; bitter phenolics
14.	**Must Treatments**	Before fermentation SO2 Clarification Enrichment or Chaptalisation Must concentration De-acidification Acidification Tannin Bentonite Flavour and colour enhancing enzymes Oxygen
15.	**SO2 in winemaking**	Prevent oxidation and premature fermentation Kill bacteria (for whites) Stun weaker yeasts Improve extraction of polyphenols from skins (for reds) Four properties: Antiseptic - kills microorganisms (acetobacter/wild yeasts) Antioxidant - binds with oxygen Antioxidasic - denatures oxidasic enzymes Combines with acetaldehyde (by-product of oxidation)

16.	**Four forms of SO2**	potassium metabisulphate powder compressed and liquidified SO2 gas SO2 in solution (5%) Burning sulphur tablets or candles
17.	**SO2 levels**	Based on style of wine, health of grapes, pH Lower for organic wines Recommeded - White: 60-100 mg/l Red: 10-60 mg/l Limits - Dry white: 200 mg/l Dry red: 150 mg/l (red wines contain natural anti-oxidants) Off-dry white (5g/l sugar): 250 mg/l BA/TBA/Sauternes: 390 mg/l (binding power of sugars)
18.	**Free, bound and total SO2**	Free - active, protective, molecular SO2 & sulphurous acid Bound - combined with sugars, aldehydes, ketones, inactive Total - free + bound
19.	**Pre-fermentation clarification**	Remove solid particles Produce cleaner flavours, more finesse, less bitter Depend on - state of the harvest - grape processing method - wine style required (little for full-bodied, complex wines; more for delicate and highly aromatic wines)
20.	**Clarification methods**	Cold settling (common) - debourbage - by gravity - 12 to 24 hours - cool temperature (5-10 C) - clear must racked off the sediment (lees) - pectolytic enzymes and SO2 Centrifugation - high level of clarity - harsh, high risk of oxidation, expensive - large wineries Diatomaceous earth filtration - for aromatic grapes - can strip the must of nutrients for fermentation Flotation - bubbling small amounts of N, CO2 or air - catching and floating solid particles - skimmed off by a rotary suction device - large wineries or cooperatives

21. **Enrichment**	Adding sugar to increase potential alcohol No effect on wine sweetness Permitted in cool regions Unusually cool summer or early harvest in warm regions Not allowed in Italy/Spain
22. **Forms of sugar for enrichment**	Sucrose (beet sugar) or cane sugar - chaptalisation RCGM (rectified concentrated grape must) - enrichment 1 kg of sugar increase vol of wine by 0.63 l White: 1% abv require 17 g/l sugar Red: 1% abv require 19 g/l sugar (evaporation due to higher fermentation temp & pumping over)
23. **Must concentration techniques**	Vacuum evaporation - water evaporates at low temperature of 20 C - loss of aromas, hence use of chilled aroma trap Reverse osmosis - high pressure applied to must against a membrane filter - no loss of aromas - also used to remove alcohol and volatile acididty Cryoextraction - chill grapes to remove water in from of ice - no loss of aromas
24. **EU Rules on enrichment**	Wine must be > 8.5% alcohol Enriched wine < 11.5% (white) or 12% (red and rose) Concentration not to increase alcohol by > 2% or reduce vol by 20% (whichever is lower) Only one enrichment method and no blending of differently enriched wines
25. **Potential alcohol**	alcohol level that would result if all sugars are fermented
26. **Actual alcohol**	actual alcohol level after fermentation
27. **Residual sugar**	unfermented sugars (natural or added) left in the wine expressed as g/l or %
28. **Total alcohol**	actual alcohol + potential alcohol from residual sugar
29. **Natural alcohol**	total alcohol in an un-enriched must or wine
30. **De-acidification**	Tartaric acid cannot be reduced by > 1 g/l Not permitted in warmest regions - CIII(b) Increase pH, therefore risk of microbial infection and decrease effectiveness of SO_2
31. **De-acidification methods**	Tartaric only - potassium bicarbonate (potassium tartrate crystals) - calcium carbonate (leaves high level of calcium tartrate) Malic only - malolactic fermentation Both tartaric and malic - double-salt de-acidification - Acidex (specifially prepared calcium carbonate with small amount of calcium tartrate-malate) - calcium tartrate-malate crystals

32.	**Acidification**	"buffering" effects logorithmic pH scale - more acid to alter pH from 3.2 to 3.0 than from 3.8 to 3.6 CII and CIII zones Not in Rhone Tartaric acid for acidification - 1.5 g/l in must; 2.5 g/l in wine Citric acid - 1 g/l in must - never added before fermentation - metabolised by yeast and bacteria to form acetic acid
33.	**Tannin**	Added before fermentation Protection from oxidation Stablilize colour Improve mouth feel
34.	**Bentonite**	Fining agent in form of clay Remove proteins Non-selective and remove flavour compounds
35.	**Flavour and colour enhancing enzymes**	Aid juice extraction Optimise extraction of aroma precursors Improve colour extraction Increase efficiency of settling Developed from fungi Added at crushing
36.	**Use of oxygen in winemaking**	Hyperoxidation Development of yeasts at start of fermentation Revitalization of yeast Micro-oxygenation of harsh polyphenols in barrels Anaerobic maturation after bottling (not for screwcaps) Add complexity and character in anaerobically made wines
37.	**Oxidases**	Laccase - grey rot - SO_2 resistant - pasteurisation (heating must to 65-70 C) Tyrosinase - controlled by SO_2 Copper and iron
38.	**Reductive (anaerobic) handling**	Minimize exposure to oxygen SO_2 Low temperatures Inert gases used to flsuh out presses, pipes, vats Reductive taint - sulphur dioxide becomes hydrogen sulphide
39.	**Oxidative (Aerobic) handling**	Minimal use of SO_2 Controlled exposure to oxygen Develop complex flavours and aromas Enzymatic oxidation of phenolics is encouraged Form insoluble polymers removed by clarification More stable wine Production of oloroso Sherry, tawny Port, vin jaune from the Jura, some Tokaji

40.	**Hyperoxidation**	Bubbling air through the juice Colour stabilisation in white wines Can decrease aromalics (e.g. Sauvignon Blanc)
41.	**Effects of excessive oxygen**	Acetaldehyde (ethanal) --> flat sherry-like flavour Bitter-tasting components from oxidation of phenolics Spoilage bacteria, e.g. acetic bacteria
42.	**Ascorbic acid**	Vitamin C Antioxidant No antiseptic effect Used without SO_2 --> hydrogen peroxide (bleaching agent)
43.	**Alcoholic fermentation**	glucose/fructose + yeasts --> ethanol + CO_2 + energy 180 g sugar --> 92 g alcohol + 88 g CO_2 Saccharomyces yeast 16-18 g/l sugar needed to produce 1% abv (8 g/l) Glucose - dominant early in ripening process - yeast prfer glucose Frutose - dominant in very ripe grapes - late harvest or botrytis-affected grapes - difficult to ferment fructose-rich grape must to dry wine
44.	**Rate of fermentation**	Concentration of sugars Availability of oxygen Temperature Type and quantity of yeasts Nutrient content of the must SO_2
45.	**Fermentation ceases**	All sugar consumed Alcohol reaches 15% killing yeasts Increasing pressure of CO_2 to 7 atmospheres Chilling to low temperature (5 C) SO_2 Pasteurisation (80 C for a few second) Removing yeasts (filtration, centrifuge) Fortification with spirit
46.	**By-products of fermentation**	Glycerol (Glycerine) - smoothness and weight of wine Acetaldehyde Ethyl acetate (nail polish) Aroma esters Fusel oils, e.g. methanol

47.	**Fermentation vessels**	Stainless steel tanks - easy to clean and maintain - allow temperature control - rotofermenters Wooden fermentation vessels - piece (228 liters) in Burgundy - barrique (225 litres) in Bordeaux, New World - open top wooden vats - 1000-5000 litres - wood retains heat well, need temp control - difficult to keep clean - chestnut, cherry, acacia & wallnut Cement tanks - lined with glass or epoxy - cheap - easy to clean and maintain - no oxygen exchange - simple temp control
48.	**Uninoculated fermentations**	Started by indigenous yeasts - Kloeckera/Hanseniaspora - Candida - Metschnikowia Around 4% alcohol - Saccharomyces takes over - Saccharomyces cerevisiae Pros: complex wine Cons: off-flavours, oxidation, microbiological spoilage Pied de curve - starter culture
49.	**Inoculated fermentation**	Commercially available active dry yeast - different strains of Saccharomyces cerevisiae - higher tolerance of SO_2 Pros - active fermentation onset - handle highly clarified juice - fermentation rate more even and easy to control - no off-flavours or aromas - efficient conversion of sugar to alcohol - decreased risk of stuck fermentations - low volatile acidity (acetic acid) production Attributes - tolerance to higher sugar levels (Lalvin Rhone 2226) - higher glycerol production levels (Maurivin Cru-Blanc) - efficent extraction of phenolics and enhancement of tannin structure for high quality reds (Lalvin Rhone 2323) - low temperature tolerant for very fruity whites (R2) - low foaming (champagne yeasts, e.g. Premier Cuvee for secondary fermentation in bottle) - Sauvignon Blanc yeasts for aroma/thiol fixing (Lalvin K1V-1116)

50. **Monitoring and controlling fermentation**

Density
- measures sugar (not alcohol)
- Baume (France): relative density
- Brix or Balling (Australia, NZ, US): hydrometer measurement
- Oechsle (Germany, Switzerland): hydrometer scale
- Babo (Italy), same as KMW (Austria)

Temperature
- controls the rate of fermentation
- chill white grapes/must in warm climates
- fermentation releases heat

Aeration
- yeast needs oxygen
- reds: pumping over (remontage) or punching down (pigeage)

Finishing the fermentation
- density drops below 1
- 2 g/l of unfermentable sugars in dry wines

51. **Temperature in fermentation**

Optimum fermentation temperature range
- whites: 10 - 18 C
- reds: 20 - 32 C

Excessively high temperature
- oxidation, microbiological spoilage and instability
- loss of aroma and flavour compounds, alcohol
- slow or stuck fermentation (above 35 - 38 C)

Excessively low temperature
- retention of isoamyl acetate (banana/pear) in whites
- poor extraction of colour and tannins in reds
- sluggish fermentation
- high levels of ethyl acetate and volatile aroma

52. **Options for finishing the fermentation**

Aromatic dry white wines
- chill the new wine
- add SO2 (40-100 mg/l)
- remove lees (settling or fining agent)
- rack clean wine and bottle

Full-bodied Chardonnay
- fermented in oak barrels
- extended lees contact, with lees stirring
- MLF
- after MLF, suphited and left to mature in oak

Off-dry white wines
- stop fermentation before dryness
- chillded (< 5 C)
- racked and filtered to remove yeasts

Sweet fortified wines (Port/vins doux naturels)
- add alcohol to > 15% abv

Red wines
- maceration to extract tannins and pigments
- New World: fermentation completed in barrels, then MLF

53.	**Fermentation problems**	Stuck fermentations Yeast nutrient issues Hydrogen sulphide formation Carbon dioxide poisoning
54.	**Stuck fermentation**	results in - hydrogen sulphide (VA) - microbial spoilage - residual sugar caused by - too hot (> 35 C) or too cold - nutrients depleted - alcohol level (uninoculated fermentation) prevented by - adequate aeration at onset of fermentation - 100 - 150 mg/l di-ammonium phosphate (DAP) - 0.5 mg/l thiamine (vitamin B) - temperature control "kick-start" - adjust temperature - add DAP and thiamine - re-inoculate with Saccharomyces Bayanus
55.	**Yeast nutrient issues**	Low yeast nutrients in rotten fruit and clarifed must Add DAP (200 mg/l) and thiamine (1.0 mg/l) Ammonium sulphate liberates ammonium and SO2
56.	**Hydrogen sulphide formation**	Yeasts deprived of nitrogren (ammmonium) Break down amino acids to release H2S Rotten eggs
57.	**Carbon dioxide poisoning**	Colourless, odourless, potentially lethal Heavier than oxygen Good ventilation required Measure oxygen using a meter
58.	**White winemaking**	Grapes pressed before fermentation Good quality whites - healthy, ripe grapes - careful and quick processing - protection from oxidation Key decisions - whole bunch press or de-stem and crush before pressing - de-acidify, acidify, increase sugar levels - skin contact (maceration pelliculaire) or press immediately - clarify must before fermentation - inoculate - fermentation vessel - fermentation temperature (14 - 20 C) - lees contact - MLF (No SO2, 16 - 18 C) - oak - maturation prior to bottling

59.	**Fermentation temperature for whites**	Optimum 14 - 20 C - fruit preservation - > 20 C reduce esters and increase alcohol Aromatic whites - 11 - 15 C to retain fruit esters - 10 - 13 C to retain volatile esters but produce intense smelling esters (isoamyl acetate) After fermentation, lower temp to 12 C for yeast settling
60.	**Lees contact**	Protect wine from oxidation Add texture Autolysis of yeast in lees Muscadet Reduction problems - H2S --> onion-like mercaptans, difficult to remove - oxygen by lees stirring or wine racking - pass through copper pipe or add copper sulphate Lees stirring (battonage) - wine in barrique (Chardonnay) - barrel stackers with rollers to avoid excess oxygen - bubbling gas in tank
61.	**Rose winemaking**	Drawing-off method - saignee or bleeding - de-stemmed, crushed and sulphited grapes - 6 - 48 hours of skin contact - cooler temp to retain fruit aromatics and freshness - higher temp for more colouring - fermented at 15 - 20 C - no MLF to retain fresh natural acidity - clarified, stabilised and bottled young - Anjou, Bordeaux Clairet, Cotes de Provence Direct pressing - freshly harvested red grapes - not to extract too much tannin - pale pink - Cotes de Provence, Languedoc Blending - Rose Champagne, New World Roses - not permitted in EU for still roses
62.	**Definition of "red wine"**	A macerated wine. Extraction of solids from grape cluster (specifically from skins, seeds and possibly stems) accompanies the alcoholic fermentation of the juice.
63.	**Red winemaking**	Skin contact during the alcohol phase and colour of the grape; extraction of phenolic compounds (polyphenolics or polyphenols); pressing after fermentation 5 main steps - pre-fermentation processing - alcoholic fermentation - draining and pressing - MLF - maturation

64.	**Two main types of phenolic compounds**	Non-flavonoids - simple phenolics - benzoic and cinnamic acids Flavonoids - catechins (tannin) - resveratrol - anthocyanins (red pigments in skin cells) - tannin can react with anthocyanins to fix colour - pigmented tannins polymerise with age and precipitate out
65.	**Three factors of phenolic extraction**	Temperature of fermentation DAP management Duration of skin contact
66.	**Pre-fermentation processing**	De-stemming and crushing (not for carbonic maceration) Fill vessel to < 80% capacity 20 - 80 mg/l SO_2 (wild yeasts, bacteria, oxidative enzymes) Must adjustment (acidification, enrichment) Pre-ferment maceration (or "cold soak") to extract aromas - Cooled to 4 - 15 C and kept for 3 - 7 days (80-100 mg/l SO_2)
67.	**Fermentation temperature for reds**	20 - 32 C Higher temp increase breakdown of skin cells and level of dissolution of phenolics Moderate temp (25 C) - good colour extraction - preservation of primary fruit aromas - minimal to moderate tannin extraction Thermovinification - heating grape to 45 C - rather coarse wines with "burnt" aromas
68.	**Cap management**	Pomace cap Methods - pumping-over (remontage) - punching down (pigeage) - rackand return (delestage) - submerged cap - rotovinification - autovinification

69. **Pumping-over**

Remontage

with or without aeration
pump, hose, fixed spray head
done 1-3 times a day

Benefits
- simple
- good extraction
- tank of wine becomes homogenised
- aeration prevents reduction, aids yeasts
- prevents cap from drying out

Wines
- Cabernet Sauvignon, Merlot
- medium to high quality
- rich, full-bodied structure
- no vegetal or bitter characters

70. **Punching down**

Pigeage

Manual (paddle)
Automatic (stainless steel cone attached to a hydraulic piston)
Done 1-3 times a day

Benefits
- gentle extraction
- less harsh or bitter compounds
- good disperson of temperature
- avoid bacterial spoilage on surface of cap

Disadvantages
- labour intensive if done manually
- Merlot and Cabernet Sauvignon more rustic in flavour

Wines
- Pinot Noir and premium Syrah

71. **Rack and return**

Delestage

Tank is drained into another tank, then pumped back over the cap
Done once per day or twice during fermentation
- after initial peak of temp
- middle of fermentation

Benefits
- complete mixing and breaking up of cap
- good aeration
- extraction of phenolics
- seeds can be removed

Disadvantages
- too extractive

72.	**Submerged cap method**	Fermenting fluid filled to over head boards/perforated screen that trap pomace beneath Constant contact Benefits - good extraction - no risk of pomace cap drying out and VA Disadvantages - extraction can be difficult as skins are compressed
73.	**Rotovinification**	Rotofermenter - horizontal cylindrical fermentation vessel - motor Benefits - fast - thorough mixing - good extraction - automatic and computer-controlled - pomace kept wet Disadvantages - expensive - robust supporting framework - reduction problems - over extraction Wines - inexpensive, bulk reds - premium Barolo
74.	**Autovinification**	Autovinifier, or Algerian Ducellier system - extended version of pumping-over - sealed vats - CO_2 pumps must into top reservoir - cascades back into lower chamber Benefits - no external power - fully automated - good extraction of colour and tannins Disadvantages - difficult to control rate of extraction Wines - red Port - light, good quality wine in N Afriaca
75.	**Fermentation management of reds**	Complexity of maceration dynamics Monitor density and temp Control of temp Control of aeration Pumpovers and/or cap punching Skin contact time (post-ferementation maceration)

76.	**Duration of skin contact**	Extraction enhanced by - higher temp - increase in alcohol Extent of phenolic extraction - avoid extraction from poor quality grapes - shorter (around 8 days) for light, easy, early-drinking reds - longer (3 weeks) for full-bodied reds - extended (> 1 months) for high quality vintages Pectolytic enzymes to increase extraction Anthocyannis extracted first (temp) Tannin extracted by higher temp and alcohol
77.	**Draining and pressing**	Free-run wine and press wine Fining of press wine Residual sugar in press wine to ferment out
78.	**Maturation**	Lees contact - reducing properties - fuller, smoother wines - mannoproteins released by lees autolysis - inhibit tartrate crystalization - bind with tannins to reduce astringency
79.	**Malolactic fermentation (MLF)**	Conversion of malic acid in a wine to lactic acid through the action of naturally-occurring or added bacteria 3 species of lactic acid bacteria - Lactobacillus - Leuconostoc - Pediococcus Traditionally in tank Today, commonly in barrel for better oak integration Biologically more stable wine Softer, rounder acidity - malic is sharp (unripe apples) - lactic is softer (milk) By-products - diacetyl (buttery richness) - higher VA
80.	**Conditions for MLF**	pH between 3.3 - 3.5 Temp between 18 - 25 C < 50 mg/l total SO_2 Certain amount of nutrients
81.	**Preventing MLF**	Clarify (remove nutrients and bacteria) SO_2 addition after primary fermentation Low storage temp (< 12 C) pH below 3.1 Clean containers Sterile filtration & bottling

82.	**Encouraging MLF**	Keep wine in lees Low levels of SO_2 Warm temp (18 - 22 C) pH above 3.3 Add Leuconostoc oenos (freeze-dried)
83.	**Monitoring MLF**	CO_2 Reduction of malic acid Paper chromatography Enzymatic analysis
84.	**Effects of MLF**	Deacidification - cool climates - incomplete ripening Stability - consuming bacteria nutrients - useful in reds as lack of protection of added SO_2 Loss of primary fruit aromas - detrimental to aromatic whites Addition of aromatic compounds e.g. diacetyl - spoil fruit aromas of Riesling or Sauvignon Blanc Increase VA - breakdownof citric acid Spoliage if lactic acid bacteria not controlled - SO_2, low pH, equipment hygiene Should never occur in the bottle
85.	**Carbonic maceration**	Fermentation within berries; no yeast; anaerobic respiration of grapes converts sugars to ethanol Whole bunch Blanket with CO_2 Intercellular fermentation 2% abv and aromatic compounds Decrease in malic acid, increase in pH 1-3 weeks Aromas of bananas, kirsch, cherry, plum
86.	**Semi-carbonic maceration**	Beaujolais Comibination of extra- and intracellular fermentation No CO_2 blanket Vat filled with grape bunches Fermentation of crushed bunches at bottom release CO_2 Intercellular fermentation of upper layer bunches Deeply coloured, fruity wines with soft tannins
87.	**Thermovinification**	Heat to 60 - 80 C for 20 - 30 minutes then cool to ferementation temp Max colour extraction "Time saver" Destroy damaging oxidative enzymes in rotten grapes Pectolytic enzymes and aromas destroyed Not for premium reds

88.	**Flash expansion**	Flash detente Pre-heat grapes to 65 - 90 C and place in vacuum Grapes cooled immediately to 30 - 35 C Rapid release of anthocyanins and tannins Juice drained off
89.	**Sparkling winemaking**	Bottle fermented Traditional Method (methode champenoise) - produce dry base wine - no SO2 added at end of fermentation - add liqueur de tirage and yeast - bottled and sealed (cork or crown seal) - secondary fermentation to increase 1.2 - 1.3% abv - autolysis of yeasts to add complexity - riddled by hand or automatic ridding machines (remuage) - disgorgement - add liqueur d'expedition - sealed by cork and wire cage (muselet) - further aging - packing and distribution - Champagne, Cava, premium sparkling wines - complex wines, bready, biscuit flavours Transfer Method - fermented wine emptied into pressurized tank - cooled to -5 C - add dosage (sweetening wine) - filter to bottle - slight loss of quality - mid-market New World sparkling wines Tank Method (cuve close or Charmat) - secondary fermentation in sealed pressurised tank - lees contact - sweetened, filtered and bottled under pressure - lower production costs - German Sekt and Prosecco - coarser and broader bubbles Carbonation (Pompe bicyclette) - chill wine - bubble carbon dioxide into it - very infereior method Asti Method & Methode Ancestrale - Moscato - must pumped into a pressure vessel and yeast added - CO2 allowed to escape to atmosphere - 5% abv: valves closed to trap CO2 - 6-9% abv and 60-100 g/l sugar: cooled to 0 C - clarified, filtered and bottled

90. **Fortified Winemaking**

Types
- Port, Sherry, Madeira
- Muscat in Australia, S France, Greece, Italy
- Vin de Constance (S Africa)
- Malaga (S Spain)
- Mavrodaphne (Greece)
- Commandaria (Cyprus)

Methods
- fortified during fermentation
- fortified after fermentation

91. **Fortification during fermentation**

Vins doux naturels
- Muscat, Grenache (S France)
- at 5% abv, add high-strength grape spirit (95% abv)
- 15 - 18% abv

Port
- maceration in granite troughts (lagares)
- fermentation at high temp (> 30 C)
- drain wine at 6 - 9% abv
- 1 part of spirit (77 - 79% abv) to 4 parts of wine
- 18 - 19% abv

Maturation
- 550 litre "pipe"

Port quality
- base wine
- single vintage or blend
- time in cask
- filtered?

Styles
- Ruby Port (< 3 yrs)
- Tawny Port (longer oxidative time)
- Late Bottled Vintage Port (4-6 yrs)
- Vintage (2-3 yrs)

92. **Fortification after fermentation**

Sherry
- Town of Jerez
- Palamino, Pedro Ximenez
- 70% free run for Finos, next 20% for Oloroso
- acidified with tartaric acid
- 600 litre oak butts
- uninoculated fermentation (25 - 30 C)
- dry wine, low in alcohol (11 - 11.5%)
- Finos/flor (14.5 - 15.5%) (biologically aged)
- Oloroso (18%) (oxidatively aged)
- Amontillado (aged both biologically an oxidatively)

93.	**Solera system**	Criadera (row) - simple solera: 3 - 4 criaderas - complex solera: 14 criaderas - bottom row called Solera Fractional blending - no more than 1/3 of contents drawn - complex wines - replenish nutrients for flor Finos: 3 - 5 yrs Amontillados/Olorosos: 5-10 yrs Swettened prior to bottling - Pedro Ximenez (Cream Sherries and Sweet Orlorosos) - concentrated grape juice (Pale Cream Sherries) Membrane-filtered for Finos and Manzanilla (salty)
94.	**Sweet wines**	3 main methods - interrupting the fermentation - adding a sweet component - concentrating the natural sugars
95.	**Interrupting the fermentation**	Fortification - Vins doux naturels e.g. Muscat de Beaumes de Venise - Moscatel de Valencia - Liqueur Muscats e.g. Rutherglen Muscat Add SO_2 and lower temp
96.	**Adding a sweetening component**	RCGM Sussreserve (unfermented grape juice) - German QbA wines - Rheingau, Rheinhessen, Mosel
97.	**Concentration of sugars**	Drying, e.g. on straw mats - passerillage - Amarone, Vin Santo (Italy, Santorini), PX Sherry (Spain) Freezing - Icewine/Eiswein Noble rot - botrytis cinerea - Riesling, Semillon, Chenin Blanc - Sauternes, Monbazillac in France; Tokaji in Hungary; Beerenauslese and Trokenbeerenauslese in Germany and Austria; botrytis Semillon in Australia