

in a plant cell you can see

↳ vacuole, chloroplast, nucleus, cell wall - 1-2µm apart

↳ ruled straight line to table with pencil

↳ low power plan - at least 4-5 layers no individual cells

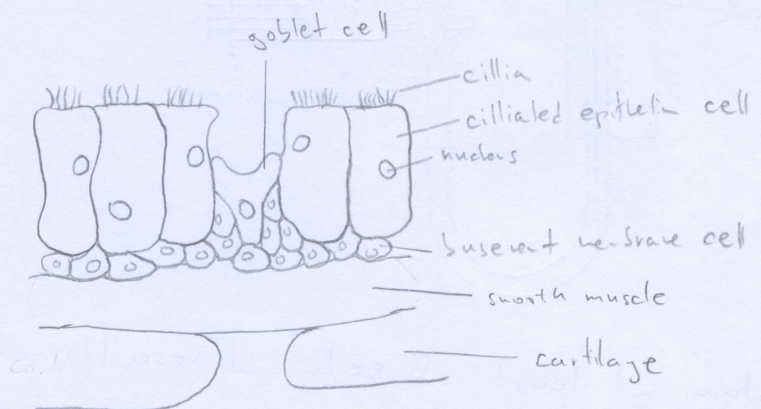
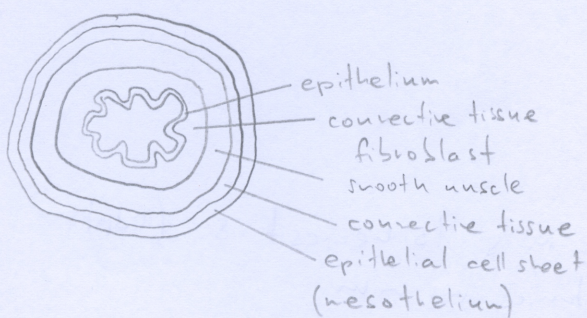
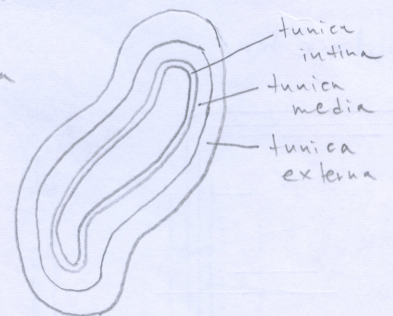
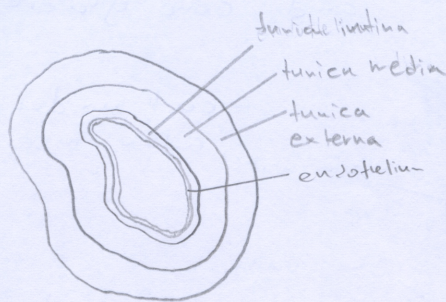
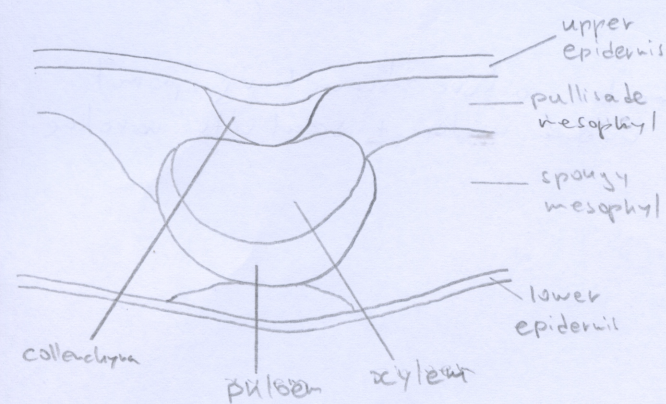
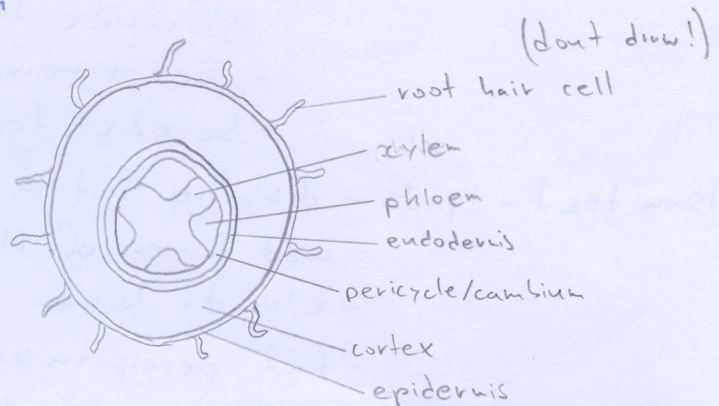
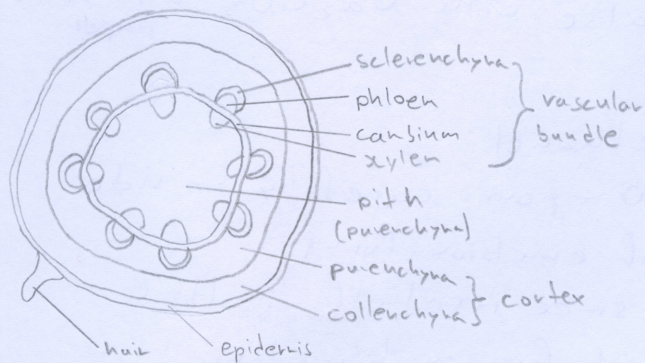
- in vascular bundle at least 2 layers (xylem, phloem)

↳ high power plan - draw exact no of cells they ask for

- adjacent cells must touch

↳ continuous single connected lines - no shading - correct proportion

↳ title of specimen, magnification



②
- globular proteins - soluble fibrous proteins - insoluble

- iodine test - starch - orange/brown $\rightarrow$ blue/black (forms complex)

- biuret test - proteins - blue $\rightarrow$ lilac/purple (peptide bonds)

- benedict's test - reducing sugars - blue $\rightarrow$ green $\rightarrow$ yellow $\rightarrow$ brick red

- heat to at least 50° semi quantitative

- time till first color change - use colorimeter

- Cu^{2+} reduced $\rightarrow \text{Cu}^+ \rightarrow \text{Cu}^0$

- acid hydrolysis - sucrose - $2\text{cm}^3 + 1\text{cm}^3$ HCl heated to break

glycosidic bond

- cool + neutralise with Na_2CO_3 test pH with litmus paper

- benedict test

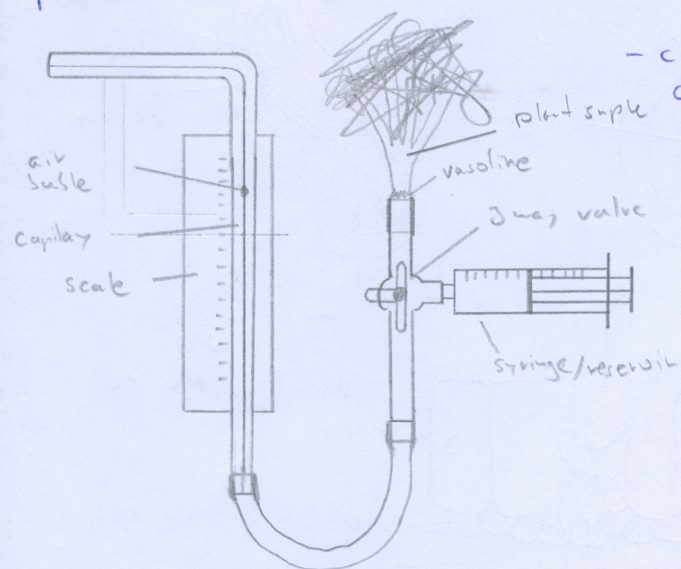
- emulsion test - lipids - dissolve fat in ethanol

- add layer of H_2O - pour carefully by side

- cloudy layer of emulsion forms

- fat precipitates since insoluble in H_2O
and conc gradient forms on boundary,

- potometer



- cut under water above branching point
also insert under water + seal with vasoline

- obtain at least 5 sets of results - time in s to nearest s (odp)
- distance in mm

- ①
- Manipulation of apparatus, measurement, observation, variables
 - ↳ independent variable - changed on purpose
 - ↳ dependent variable - changes as result and observed
 - ↳ control variables - identified + kept constant - standardised
 - ↳ qualitative - non-numerically observable
 - nominal - categorisable
 - ordinal - rankable
 - ↳ quantitative - numerically observable
 - continuous or discrete
 - Experimental skills
 - ↳ range - spread between highest + lowest value
 - ↳ increment/interval - difference between values
 - ↳ dilution
 - 1) simple - mother solution diluted into different ratios
 - 2) serial - solution diluted repeatedly by a constant ratio
 - ↳ standardising other variables
 - ↳ temp - thermostatically controlled H₂O bath
 - ↳ pH - buffer solution of known concentration
 - ↳ light intensity - heat shielded lamp set at constant power
 - ↳ wind speed - fan set at constant speed (and distance)
 - ↳ humidity - solid anhydrous CaCl (calcium chloride)
 - ↳ mass, conc, volume, age, source, storage, conditions, genotype
 - ↳ measuring quantities
 - ↳ temp - thermometer
 - ↳ colour - colorimeter
 - ↳ pH - pH meter or indicator paper
 - ↳ power - Voltmeter + Ammeter
 - ↳ mass - top pan balance
 - ↳ no of cells - haemocytometer
 - ↳ time - clock/stopwatch
 - ↳ distance - ruler/microscope + calibrated stage graticule
 - ↳ vol - beaker/measuring cylinder/burette pipette
 - quality of measurements
 - ↳ accuracy - closeness to true value - better instruments
 - ↳ precision - closeness to repeated readings - control all variables
 - ↳ reliability - confidence in results - repeat readings and take mean
 - ↳ validity - agreement between hypothesis + investigation - check relation between measured key and derived variables

- ②
- Presentation of data
 - ↳ table drawn by ruled pencil line - each column heading quantity/SI unit
 - ↳ arrange columns: - independent - dependant - derived variable
 - ↳ save no of dp in measured if is calculated
 - Biological drawings
 - ↳ low power plan - distribution of tissues - don't outline cells
 - ↳ high power plan - details of small group of individual cells
 - ↳ use all of space - show all necessary detail - correct proportions
 - ↳ clear connected single lines with sharp pencil
 - ↳ don't shade or colour
 - ↳ table using single horizontal ruled lines (non-intersecting)
 - mathematical skills
 - ↳ % error = $\frac{\text{no of readings} \times \frac{1}{2} \text{ smallest scale division}}{\text{total reading}} \times 100$
 - ↳ mean = $\frac{\sum x}{n}$ $m = \frac{\Delta y}{\Delta x}$ - draw right angled triangle!
 - draw tangent (ensure it exceeds $\frac{1}{2}$ graph)
 - ↳ magnification = $\frac{\text{image}}{\text{actual}}$
 - resolution - shortest distance between 2 distinguishable points
 - $\frac{1}{2} \lambda$ of light (EM wave) used
 - Analysis, conclusion and evaluation
 - ↳ describe overall trend! comment on changes in gradient
 - ↳ quote figures to support claim
 - ↳ conclude by connecting it to theoretical reasoning
 - ↳ conclusion - clean, focused scientifically explainable statement describing deduction of hypothesis from results
 - Errors
 - ↳ systematic - equal throughout investigation
 - ↳ random - differ throughout investigation - arise from difficulties in controlling standardised variables and measuring dependent variable
 - ↳ examples
 - ↳ anomalous readings
 - ↳ inadequate readings or intervals/range
 - ↳ uncontrolled variables
 - have at least 5 readings to plot graph