Cell organisation:

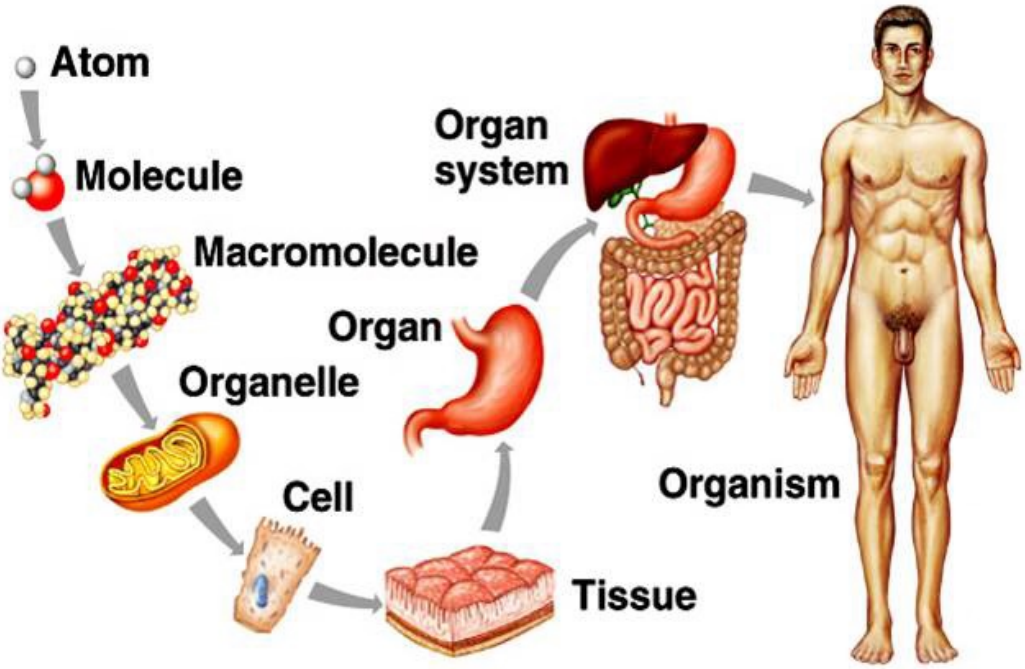
Cells -> Tissues -> Organs -> Organ system

Cells = buildings blocks of life, become specialised via differentiation

Tissues = group of cells (carry out particular function in unison) e.g. muscle (contracts), glandular (secretes enzymes) & epithelial (protection) tissue

Organs = group of tissues e.g. the stomach is made of: muscular (so stomach churns food), glandular (secretes digestive juices) & epithelial (protects stomach) tissues

Organ system= group of organs e.g. digestive system made of: glands (digestive juices), stomach (digestion), liver (makes bile), small intestine (absorbs food into blood) organs



Enzymes

Biological catalysts that increase reaction rate without being used up by reducing the activation energy
&
Proteins made of chains of amino acids

Lock & key mechanism:

Substrate binds to active site which is a complimentary (specific) shape & collisions occur

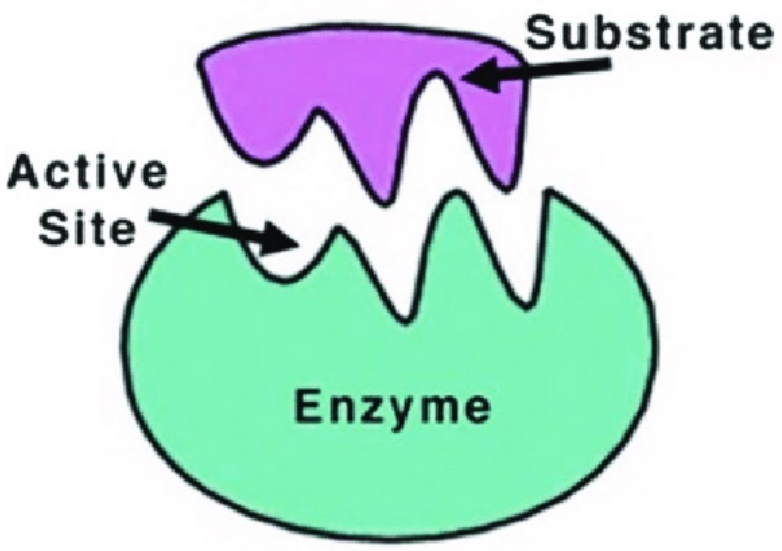
Induced fit mechanism:

Active site slightly changes shape as substrate binds to it

Optimal enzyme conditions:

Temperature: high = faster reaction rate as thermal energy converted to kinetic energy so rapid collisions but if too hot, enzyme's active site denatures so no reaction occurs. 37 degrees cel = optimum temp (body temp)

pH: too high/low interferes with bonds so active site denatures, optimum = usually pH 7 but pepsin works at pH 2 (suits acidic conditions in stomach)



Enzymes & digestion:

Big insoluble molecules = too big to be absorbed into bloodstream so enzymes break them down

Starch -> Maltose via Amylase enzyme
Amylase made in: salivary glands, pancreas & small intestine

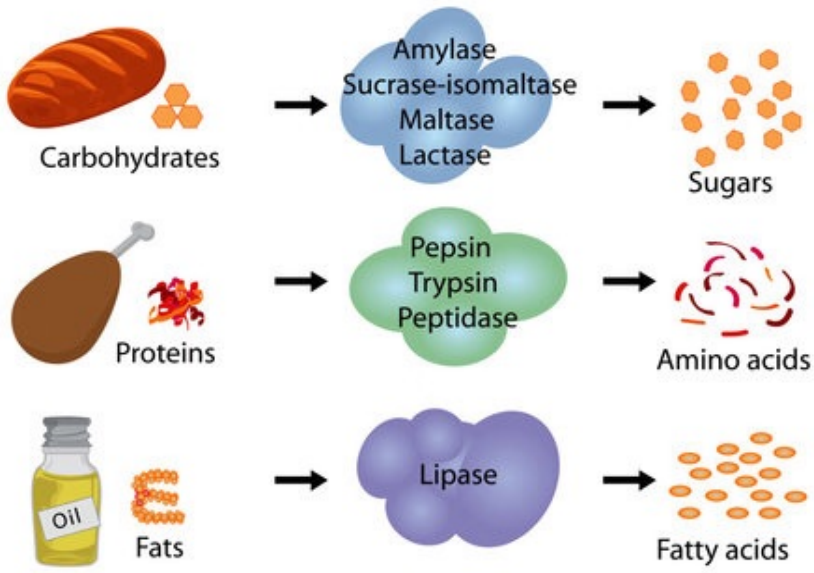
Proteins -> Amino acids via Protease enzyme
Protease made in: stomach, pancreas & small intestine

Lipids -> 3 fatty acids + glycerol via Lipase enzyme
Lipase made in: pancreas & small intestine

Product of digestion used 4: respiration (glucose) & to make new lipids, proteins & carbohydrates

Bile:
Produced in liver
Stored in gall bladder

Functions:
Neutralises stomach (hydrochloric) acid as enzymes in small intestine work best at alkaline pHs
Emulsifies fats into droplets 2 increase surface area 4 faster absorption of molecules into bloodstream during digestion



Digestion:

Digestive enzymes produced by specialised cells in glands & in gut lining

Digestion process:

Tongue

Salivary glands: produce amylase

Oesophagus

Stomach: churns food with muscular walls, produces pepsin, produces hydrochloride acid (to kill bacteria, to give right pH for protease to work in- pH 2)

Liver: bile is produced (neutralises stomach acid & emulsifies fats)

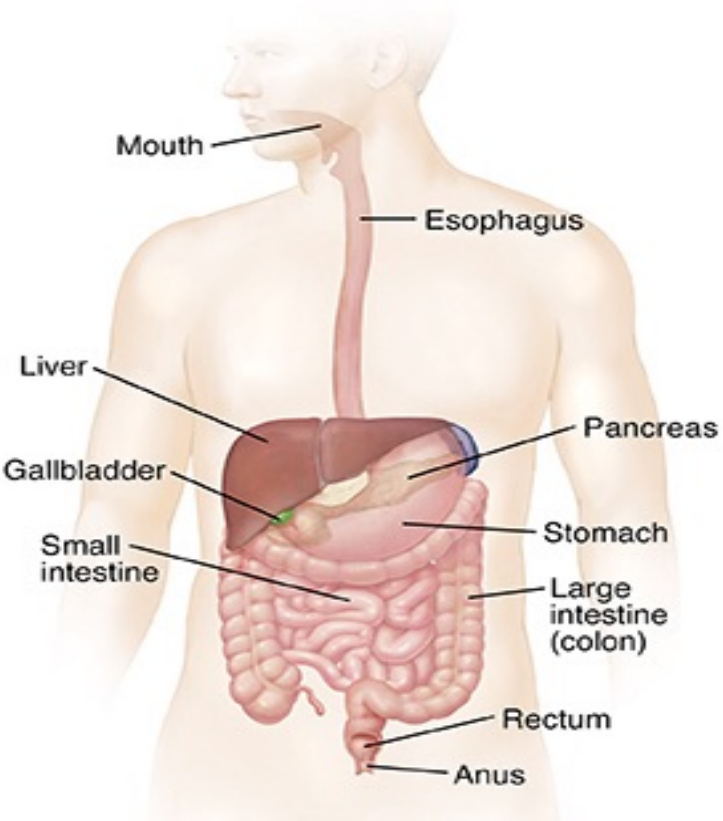
Gall bladder: stores bile

Pancreas: produce lipase, protease & amylase

Small intestine: where food is absorbed into blood, enzymes produced here

Large intestine: excess water is absorbed from food

Rectum: faeces stored here prior to exiting via anus



Food tests:

Food sample prep:
Break up food in pestle & mortar
Transfer 2 beaker with water
Stir with glass rod 2 dissolve food
Filter solution through funnel

Reducing sugars via Benedicts:
Prep food sample, add to test tube, heat water bath to 75 degrees cel, add benedict's solution with pipette, leave test tube in bath for 5 mins
Presence of sugars= brick-red solution

Starch via Iodine:
Transfer food sample to test tube, add iodine & shake gently
Presence of starch = orange -> blue-black

Proteins via Biuret:
Transfer food sample to test tube, gently shake after adding biuret solution
Presence of protein= blue -> purple

Lipids via Sudan III:
Prep sample (don't filter it) & add to test tube, add Sudan solution & shake
Presence of lipids= mixture separates into 2 layers (top is bright red)

Sudan 3 test for lipids results (1st tube = positive as layers)

Lungs:

Located in thorax, separated from lower body by diagram, protected by ribcage & membranes

Air breathed in -> trachea -> bronchi -> bronchioles -> alveoli 4 gas exchange

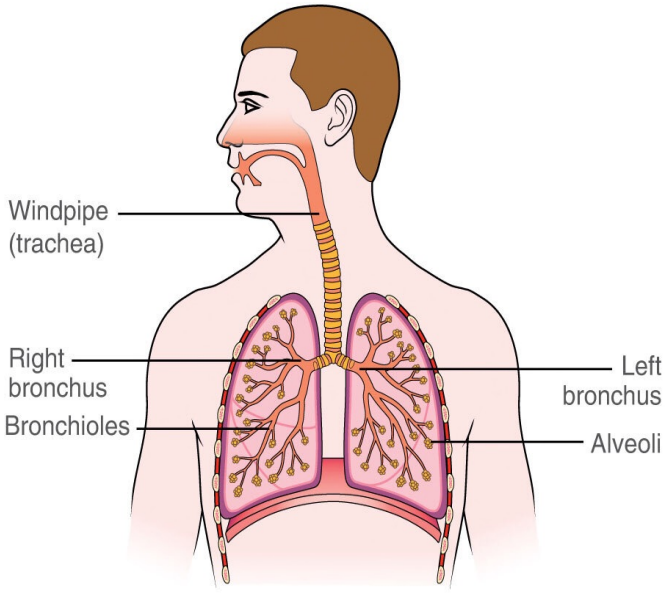
Alveoli:

Tiny air sacks surrounded by blood capillaries

Air -> lungs -> O2 to cells (via red blood cells) -> alveoli so little O2 & lots of CO2

O2 diffuses out of alveolus into blood, CO2 diffuses into alveoli to be exhaled

Breaths per minute = number of breaths / number of minutes



Upwards and outwards	**RIB CAGE**	Downwards and inwards
Contracts, moves down and flattens	**DIAPHRAGM**	Relaxes and curves upwards
Bigger	**THORACIC CAVITY**	Smaller
Decreases	**AIR PRESSURE**	Increases
Enter into the lungs	**AIR**	Air forced out of the lungs

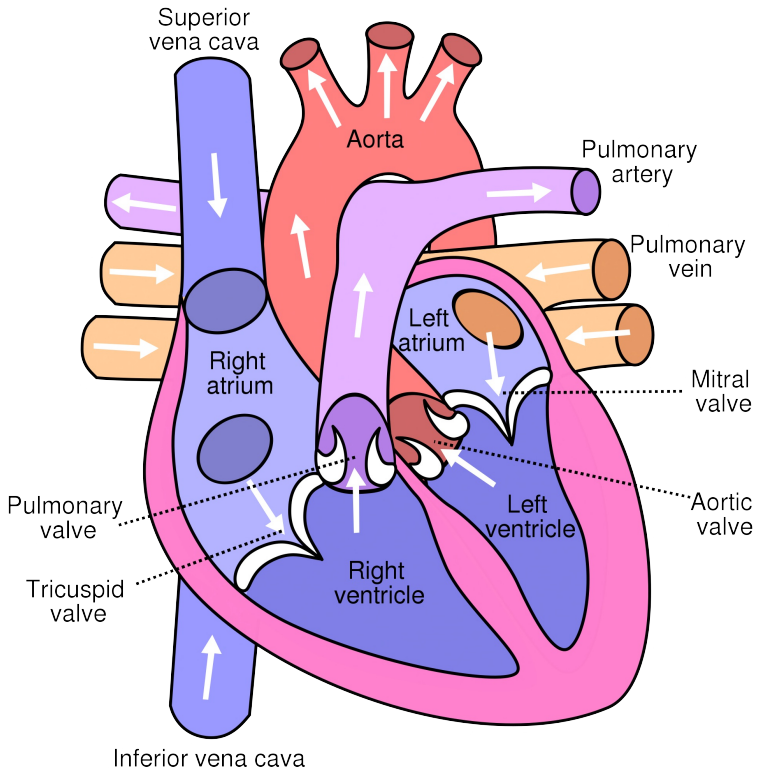
Circulatory system:

Humans have a double circulatory system: right ventricle takes deoxygenated blood 2 lungs, then to the heart
Left ventricle pumps oxygenated blood to cells, then back to lungs

Heart made of muscle tissue that contracts
Valves prevent back flow of blood

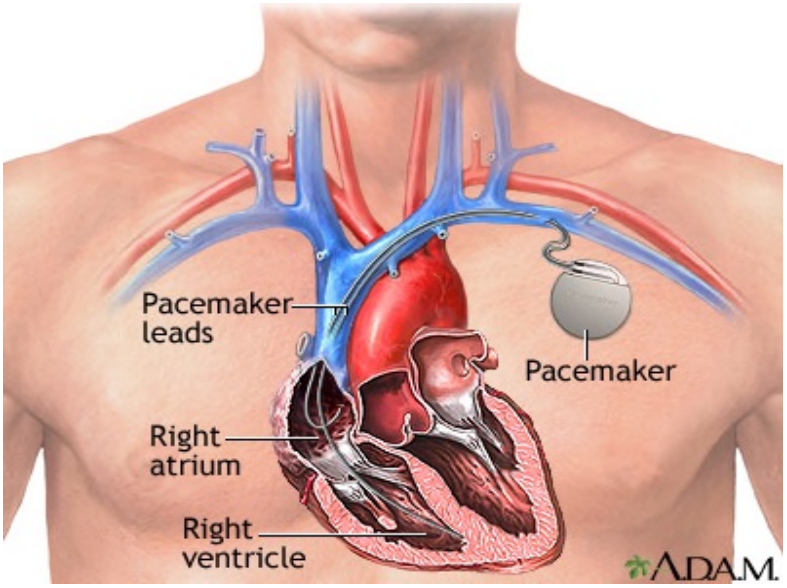
Deoxygenated blood:
Vena cava
Right atrium
Right ventricle
Pulmonary artery
Lungs for gas exchange

Oxygenated blood:
Pulmonary vein
Left atrium
Left ventricle
Aorta
Body cells receive O2



Pacemaker:

Resting heart rate controlled by cells in right atrium (produce electrical impulses for contractions)
Artificial pacemaker corrects irregular heartbeat (implant induces electrical current for contractions)



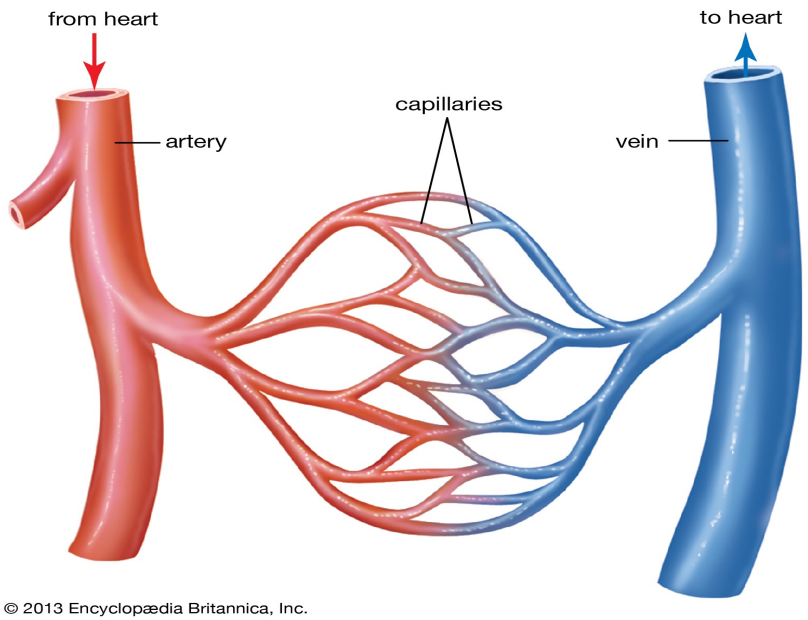
Blood vessels:

Arteries:
Carry blood AWAY from heart
Features:
Strong & elastic walls to withstand high pressure of (oxygenated) blood
Thick, elasticated walls, tiny lumen

Capillaries:
Exchange substances
Features:
Permeable walls for diffusion
Supply O2 & flood, take away waste e.g. CO2
Walls are one cell thick = shorter diffusion distance

Veins:
Carry blood TO heart
Features:
Thinner walls as blood is at lower pressure (deoxygenated)
Big lumen for blood flow
Valves prevent back flow of blood

Rate of blood flow = volume of blood / number of minutes



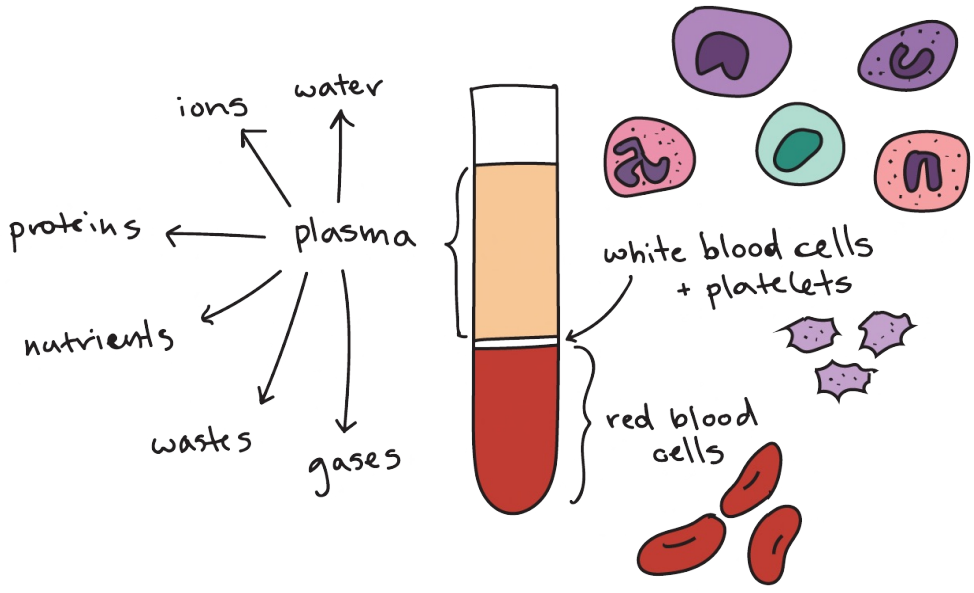
Blood:

Red blood cells:
Carry oxygenated blood to cells
Features:
Biconcave disc & no nucleus for large surface area to hold O2
Haemoglobin binds to oxygen = oxyhemoglobin

White blood cells:
Phagocytosis: engulf & ingest pathogens
Antibodies target specific antigens
Antitoxins counteract effects of toxins

Platelets:
Clot blood to prevent infection at wound sites

Plasma:
Liquid component of blood, contains:
Red & white blood cells
Glucose & amino acids
CO2
Urea
Hormones
Proteins



Coronary heart disease:

CHD caused by built up of fatty material in arteries so become narrow, prevents O2 reaching heart = heart attacks & strokes

Treatment of CHD:

Stents: mesh tubes keep arteries open so blood flows to heart
Pros: lower heart attack risk, long term & quick recovery time
Cons: surgical complications, infection & blood clots (thrombosis)

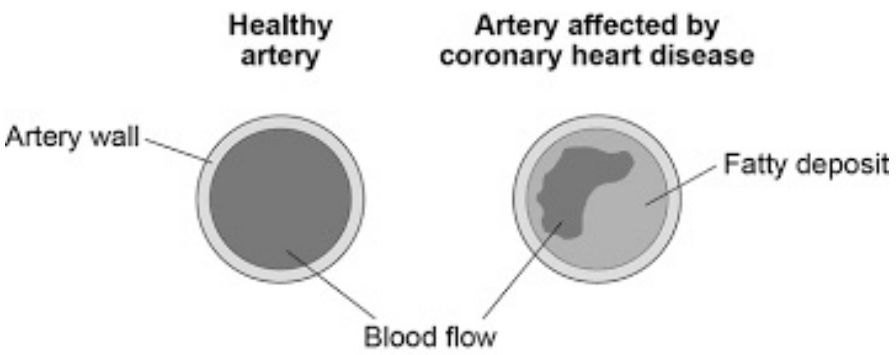
Statins: drugs that lower LDL cholesterol
Pros: increase HDL (good) cholesterol, reduce heart attack risk
Cons: long term & side effects e.g. nausea

Surgical solutions:

Artificial heart:
Mechanical hearts to allow heart to rest temporarily till donor heart found
Pros: less chance of immune system rejection
Cons: surgical risk, infection, electric motor failure, blood clots, blood-thinning drugs (cause excessive bleeding if injured)

Valves:
Biological = from humans or pigs/cows
Pros: less drastic surgery
Cons: blood clot risk & religious objections
Mechanical vales also fix stiff & leaky valves for proper circulation

Artificial blood:
Excess blood loss= heart still pumps blood if supply is topped up (using saline)
Safe if no air bubbles form, keep people alive even if they loose 2/3 red blood cells= gives time for new blood cells to form or for a transfusion



Health & disease:

Health = state of physical & mental wellbeing

Communicable diseases: spread between people, caused by pathogens e.g. salmonella (bacterial infection)
Non-communicable diseases: hereditary/terminal e.g. cancers & CHD

Disease interactions:

Hepatitis B increases chances of liver cancer, HPV can cause cervical cancer
HIV can lead to AIDS (weak immune system so can die from diseases)
Depression can be triggered by physical ailments that affect life quality

Factors effecting health:

Balanced diet accessibility
Stress
Life circumstances (medication access, condom access ect)

Risk factors = increase likelihood of getting a disease but correlation does not equal causation

Lifestyle factors:
Poor diet & little exercise -> obesity
Asbestos & radiation exposure -> cancers

Developed countries = higher incomes so more fast food but decent health care so cannot generalise

Direct risk factors:
Smoking -> CHD, lung cancer
Obesity-> type 2 diabetes
Alcohol -> liver & brain cancer
Carcinogens e.g. radiation -> cancer

No exercise & high fat diet -> hypertension & high levels of LDL cholesterol -> CHD

Non-communicable disease cost:

Large human cost: death & lower life quality
Financial cost on NHS: research & treatment, unemployment -> less tax payers

Cancer:

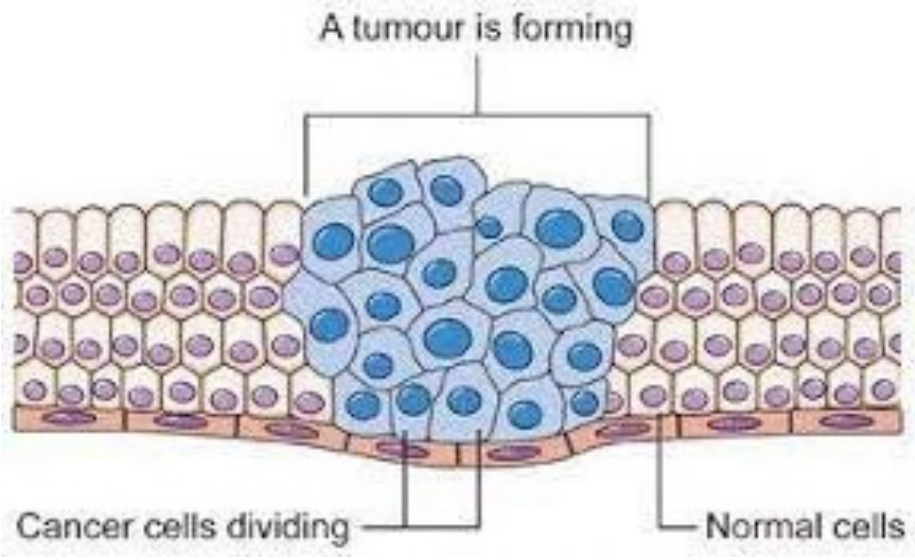
Uncontrolled cell division = tumour

Benign: localised, not cancerous
Malignant: cancerous, spreads via bloodstream & invades tissues = secondary tumours, maybe fatal

Risk factors for cancer:

Smoking-> lung & stomach cancer
Obesity-> kidney & bowel cancer
UV exposure-> skin cancer
Viral infections e.g. hepatitis B & C-> liver cancer

Hereditary:
Can inherit faulty genes = more susceptible to developing cancer e.g. BCRA genes linked 2 increased likelihood of breast & ovarian cancer



Plant cell organisation:

Plant tissues:

Epidermal: covers plant, waxy cuticle reduces H2O loss by transpiration

Upper epidermis: transparent so light passes through to palisade

Palisade mesophyll: site of photosynthesis, so lots of chloroplasts & at top of leaf for Sunlight

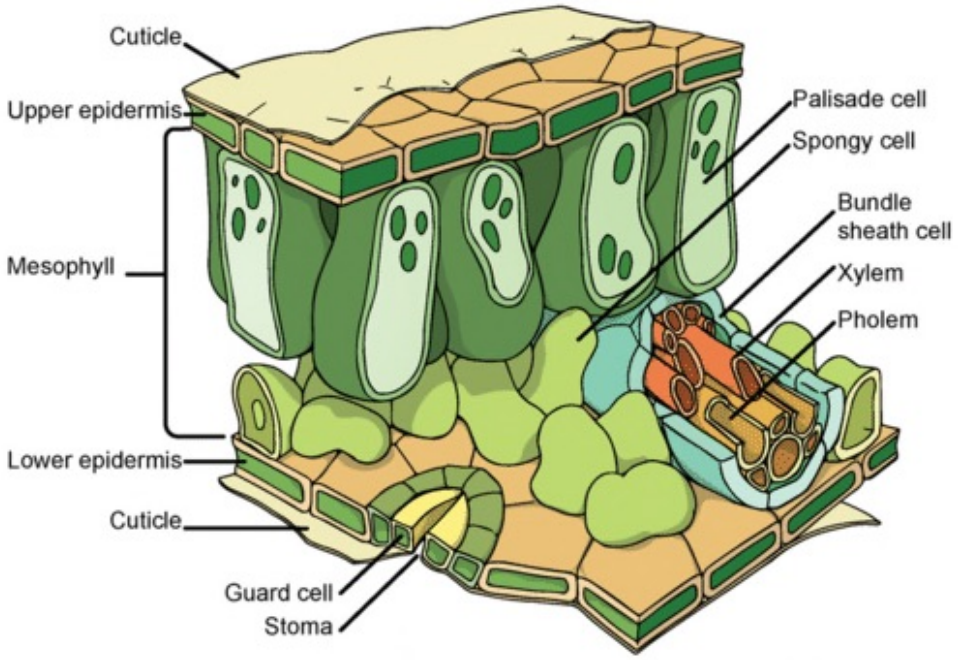
Spongy mesophyll: air spaces for gas exchange

Xylem: transport water & mineral ions

Phloem: transport dissolved sugars

Meristem: at growing tips of roots & shoots, differentiates for growth

Leaves: have stomata for gas exchange, guard cells control their opening & closing



Transpiration:

Evaporation & diffusion of H2O from leaves
Causes H2O shortage so xylem draws up more H2O to replace it
More H2O is drawn in through roots = transpiration stream

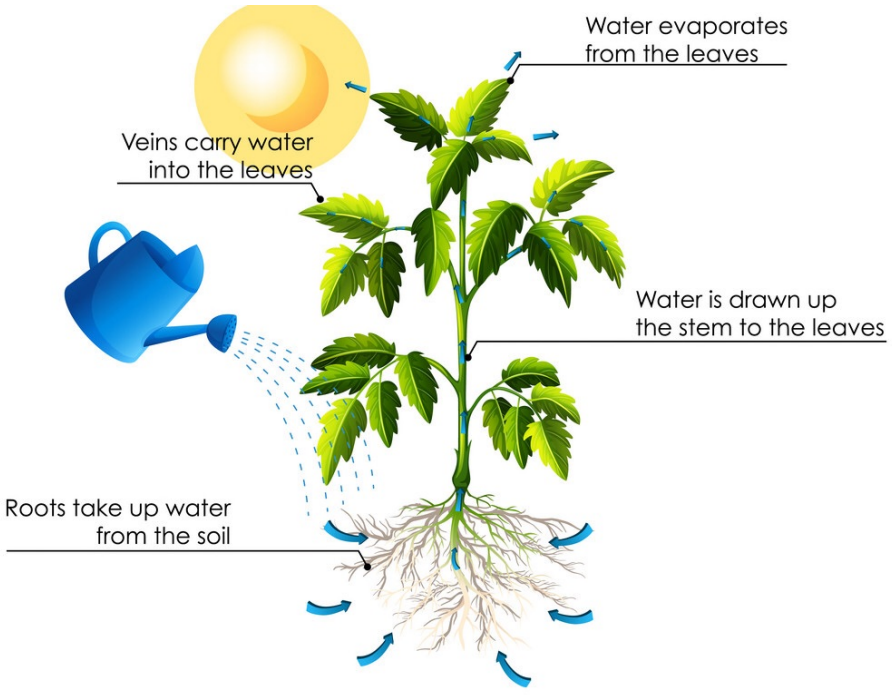
Leaves have stomata for gas exchange, so when guard cells open stomata, H2O escapes via diffusion (down a concentration gradient)

Xylem:

Hollow tubes made of dead cells, strengthened with lignin
Carry H2O & mineral ions from roots to leaf
H2O -> roots -> xylem -> leaves = transpiration

Phloem:

Columns of elongated cells with pores (for cell sap)
Transport dissolved sugars from leaves to roots for immediate use/ storage = translocation



Transpiration rate affected by:

Light intensity: brighter = faster as stomata open to let CO2 in so H20 escapes

Temperature: warmth= thermal energy converted to kinetic in particles so rapid H20 loss

Air flow: wind = H20 moves out plant as concentration gradient is maintained for diffusion

Humidity: low (dry air around leaf) = fast as concentration gradient maintained

Rate of transpiration estimated via H20 uptake of plant:
H20 uptake promotional to H20 loss by leaves
Record starting position of air bubble & record distance moved/hour

Guard cells:

Open & close stomata
Lots of H20 = stomata goes turgid (stomata opens for gas exchange)
Lack of H20 = stomata goes flaccid (prevents H20 loss by closing)
Thin outer walls & thick inner walls allows opening & closing of stomata
Close at night to conserve H20
Stomata on undersides of leaves, lower surface = shaded & cooler = less H20 loss (than on upper side)