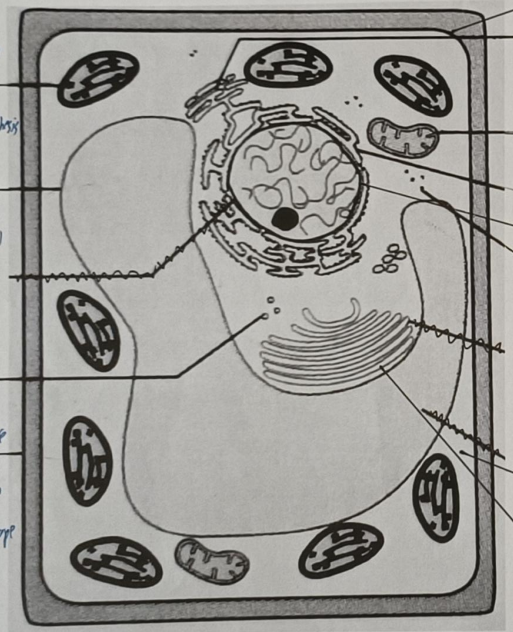
Dai Jia Cheng
V8
09

* A → A cell is a unit of life. It consist of a mass of living matter called protoplasm

→ protoplasm → complex jelly-like substance
→ where chemical activities that allow the cell to survive & grow

→ Differentiation → the process by which a cell becomes specialised for a specific function.

→ cells → tissue → organ → system



plant cell

- contain green pigment called chlorophyll
- oval structure

Chloroplasts
↓
essential for photosynthesis

large central vacuoles
↓
Plant-filled space → gas ppm
store subst. within cell → contain cell sap

vesicle

cell wall
made up of cellulose
fully permeable
protects from injuries & gives fixed shape

cell membrane
controls in and out of subst.
↓
ppm
↓
only some subst. can pass through
ppm
made up of lipids & proteins

Smooth Endoplasmic Reticulum (SER)
connected to RER
carry out detoxification
synthesis substances such as fats and steriods.
↳ sex hormones in mamals

mitochondria
aerobic respiration
↓
busier for cell activities & growth & reproduction

Rough Endoplasmic Reticulum (RER)

nucleus
surrounded by nucleus membrane
- essential for cell division
- contain genetic information in the form of chromosomes

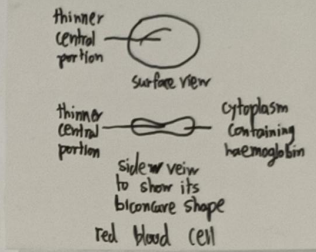
control cell activities

Ribosomes
attached to RER → synthesis proteins out of the cell
lies freely → synthesis proteins use in the cell

Cytoplasm
most cell activities occurs
contain organelles
↳ a cellular structure that performs a specific job within a cell
↳ each organelle is specialised for a particular function

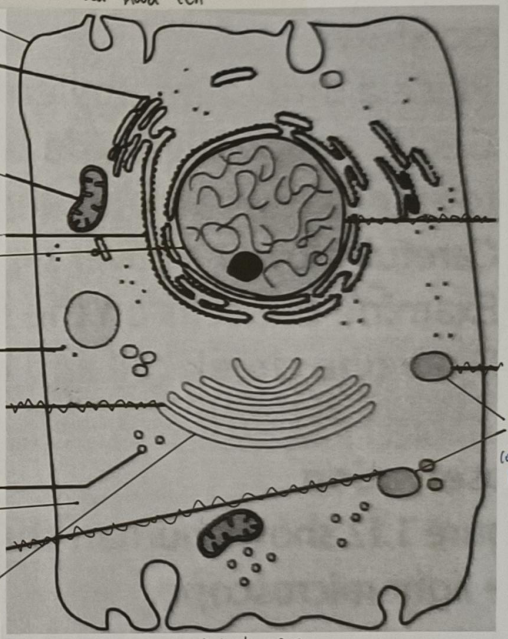
Golgi body
chemically modifies substances
stores & packages these subst.
↓
secretion.

process
↓
① vesicles transport subst. within cell. Small vesicles containing subst. made by ER are pinched off from ER
↓
② Vesicles fuse with Golgi body & release their contents into the Golgi body. The subst. are chemically modified inside Golgi body
→ ③ Secretory vesicles containing modified subst. are pinched off from the Golgi body. They then move to the cell membrane
→ ④ The secretory vesicles fuse with the cell membrane & their contents are released out of the cell.



red blood cell

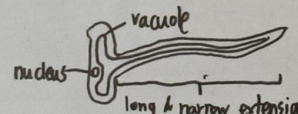
- contain haemoglobin
- has circular, biconcave shape → ↑ SAVR
- lacks a nucleus → more room for haemoglobin
- Each nucleus → store more haemoglobin
- Flexible → squeeze through capillary easily.



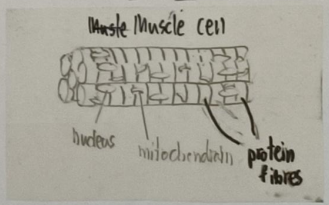
Animal cell

exist temporarily
Small vacuoles
contain water & food subst.

vesicle



- long & narrow root hair
↓
↑ SAVR
- large central vacuoles
↓
maintain ↓ water potential



- Elongated & cylinder in shape
- ↑ amt. of mitochondria
↓
aerobic respiration
- ↑ amt. of nuclei
↓
allow for cell division
- Contractile protein fibres
↓
contract & relax to bring about movement

	Diffusion	Osmosis	Active Transport
similarities			
1.	Allows substances to move		
2.	Involves movement of substances		
3.	Particles must be involved		
Differences			
1. Type of molecules	Molecules	only water molecules	Molecules
2. Concentration gradient	down	down	against
3. Energy requirement	No(passive)	No(passive)	Yes(active)
4. presence of ppm	No	Yes	Yes

Chapter 2

Cell place in lower water potential

animal

loses water

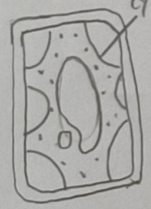
shrinks and spines appear on the cell surface

dehydrated & eventually die.

∴ The cell is crenated

plant

water molecules from the vacuole and cytoplasm leave the cell through cytoplasm ppm



loses water

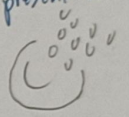
- vacuole ↓ size
- cytoplasm shrinks away from the cell wall
- If plasmolysis — the shrinkage of cytoplasm and cell membrane away from the cell wall.

- decrease size
- becomes flaccid

Cells place in higher water potential

animal

Indicate ~~the water potential~~ expands and burst → × presence of cell wall



plant – cell sap of the plant cell has lower water potential ...

- vacuole ↑ size
- pushes the cytoplasm against the cell wall

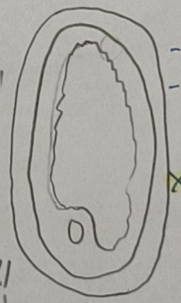
× burst - protect by inelastic cell wall

cell expands

cell become turgid

Importance of turgor

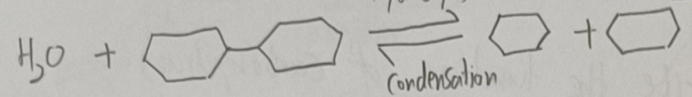
- maintain the shape of soft tissues in plants
  ↳ remain plants remain firm & erect
- Movement of certain parts.
  ↳ Changes in the turgor of the guard cell cause the opening and closing of the stomata.



format of answering.

1) Difference in conc. / water potential between the surrounding and the cell or cellsap
2) Direction of the molecules and by what? Diffusion? osmosis? active transport?
3) Indicate shrink or expand is size
4) Indicate is it crenated? / plasmolysis? / burst? / turgid?

Chpt 3



Carbon hydrates → $C_nH_{2n}O_n$

- H:O = 2:1

↳ e.g. glucose : $C_6H_{12}O_6$

sucrose : $C_{12}H_{22}O_{11}$

Single Sugar (monosaccharides)

- glucose
- fructose

double sugar (Disaccharides)

- maltose
- Sucrose

reducing sugar

Benedict test

↳ steps: 1. Place 2cm³ of food sample into a test-tube
2. Add 2cm³ of ~~food~~ Benedict solution to the food sample
3. Shake the mixture & place the test-tube in a boiling water bath for 2-3min
4. Record the colour of the solution

↳ Results: - ~~Th~~ dh - blue
- Trace - Green
- moderate - yellow/orange
- large - red

Iodine test (KI solution)

- starch
- glycogen

Complex for carbohydrates (polysaccharides)

- glycogen
- cellulose ↳ branched molecules

Suitable for storage:
- Insoluble in water } × diffuse
- large molecules } × affect w.p.
- Can easily breakdown into glucose
- Compact shape → × involve in cellular reactions
- × reactive
- release glucose as source of energy

Function of Carbohydrates
- immediate source of energy
- Substrate for respiration

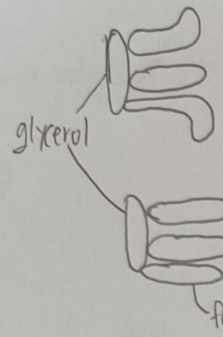
needed for:
- formation of supporting structure e.g. cell wall
- Convert into other organic compound e.g. Na & fats
- formation of nucleic acid e.g DNA
- synthesise Lubricants e.g. mucus
- Synthesis the nectar in flowers

Roles of water in ~~Oran~~ Organisms:

- Main component of organisms
  - ↳ component of cell cytoplasm
- Universal solvent & reagent & product
  - Allows dissolved subst. to be easily transported (e.g. blood)
  - Aids in temp. regulation
    - ↳ sweating & transpiration
  - Maintains shape of plant cells & plants

Describe the functions of carbohydrates in living organisms.

- Energy storage. e.g. starch & glycogen.
  - ↳ broken into glucose when needed to provide energy for cellular respiration
- As a structural molecule. e.g. cellulose in cell walls of plants
  - ↳ gives shape & prevent bursting
- Cellulose ✗ digest → act as dietary fibre
  - ↳ prevent constipation



unsaturated
↳ healthy

saturated
↳ unhealthy

Fats → C, H, O
↳ lesser proportion of oxygen to hydrogen

Function:

- long-term storage of energy
- Insulating material
- Solvent for fat-soluble vitamins & other vital subst. e.g. hormones
- ↓ water loss from skin surface.
  ↳ Glands in the skin secrete an oily subst.
  ↳ ↓ evapo. → ↓ heat loss

ethanol emulsion — liquid state:
1. Add $2cm^3$ of ethanol to a drop of liquid sample in a test-tube
2. Shake the mixture thoroughly.
3. Add $2cm^3$ of water to the mixture & shake the mixture

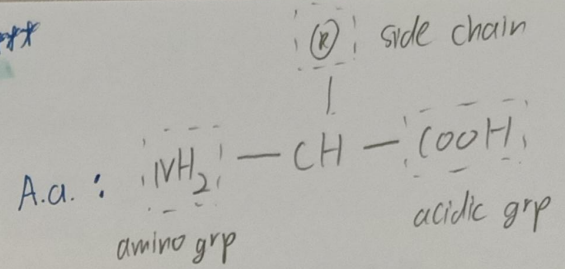
Solid state:
1. Crush the sample into small pieces using a mortar & pestle
2. place the pieces into a test-tube
3. Repeat liquid state step 1-3.
4. Allow the particles to settle
5. Decant the ethanol into another test-tube containing $2cm^3$ of water & shake the mixture

-ve results: clear
+ve results: - white emulsion produced
- test tube becomes warm

A.a → polypetide → proteins

protein → C, H, O, N^{***}

thr maybe sulfur present



function :

- Synthesis of new cytoplasm
  ↳ growth & repair of cells
- Synthesis of enzymes & hormons
- formation of ~~antibiot~~ antibodies to combat diseases.

~~for~~ biuret test

1. Add $2cm^3$ of food sample to $2cm^3$ of biuret solution
2. Shake well & allow the mixture to stand for five mins

1. Add $2cm^3$ of food sample into $2cm^3$ of dilute NaOH solution
2. Shake the solution
3. Add 1% copper (II) sulfate solution drop by drop.
4. Shake the mixture after each drop until a colour change is observed.

tve results : blue → violet

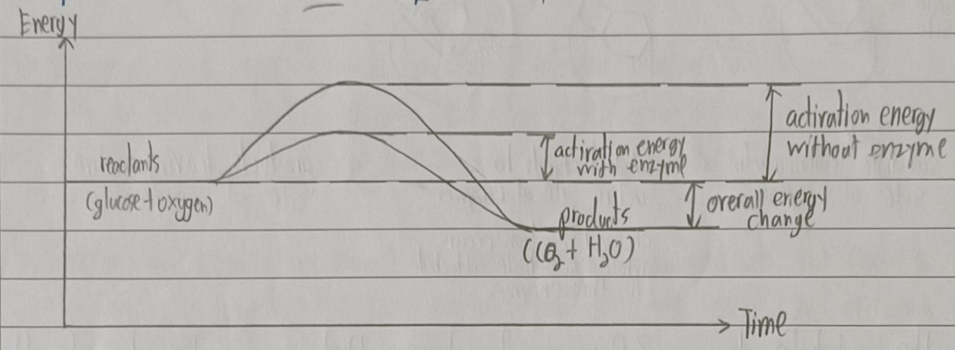
-ve results : remain blue

Chpt 4-bio

No.: Date:

→ Enzymes: proteins that function as biological catalysts. They catalyse or speed up the rate of chemical reactions. They remain chemically unchanged at the end of the reaction.

→ Enzymes lower activation energy: The energy needed to start a chemical reaction.



Note: - If the overall energy change is negative, there is a decrease in energy content.
- If the overall energy change is postive, there is an increase in energy content.

→ Break down these large molecules into simpler and smaller substances so that they are:
- Soluble in water
- Small enough to diffuse through the cell membrane.

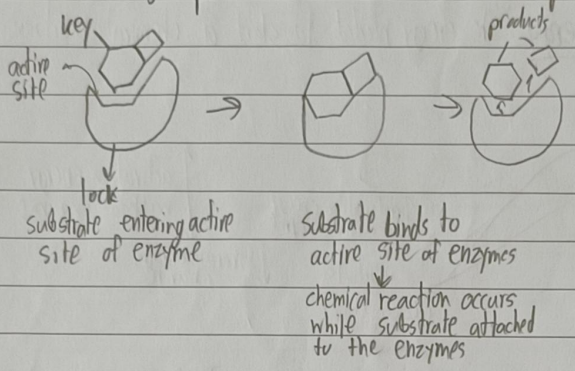
→ Anabolic reaction → build up complex substances
↳ Example: Amino acids taken into the cell may be used to build up proteins. The cytoplasm contains special enzymes to catalyse such reaction.
- In photosynthesis, glucose is synthesised from carbon dioxide and water. The chemical reaction involved in photosynthesis are controlled by enzymes.

→ Catabolic reaction → break down complex substances
↳ Examples: In cell respiration, glucose is broken down to release energy and form carbon dioxide and water. This process involves a series of chemical reactions, each catalysed by different enzyme. The enzymes act together to completely break down glucose.

No.: Date:

→ 'Lock-and-key' Hypothesis

↳ Substrates: substances on which enzymes act,
↳ E.g.: protein is the substrate on which protease acts.



1. - The substrate has a 3-Dimensional shape that is complementary to that of the active site can fit into the enzymes. → formation of an enzyme-substrate complex.
- The enzymes then catalyses the reaction, → the substrate is converted to the products.
- The products leave the active site.
- The enzyme remains unchanged → able to catalyse another reaction

- Mode of action of enzymes [Be Careful Red Light Unchanged]
  - Be: enzyme and substrate Binds.
  - C: forming an enzyme-substrate Complex
  - R: Reaction is catalysed
  - L: products Leave active site
  - U: enzymes remains chemically Unchanged

No.: Date:

→ Characteristics of enzymes

↳ **Enzymes speed-up chemical reactions** → (Save energy, saves time)
- ↳ alter the rates of chemical reactions that occur in the cell
- ↳ lowering the activation energy needed to start the reaction.

↳ **Enzymes are specific in action** → only intended reaction will occur
- ↳ only substrate with a shape complementary to the active sit can fit into the enzymes.
- ↳ Enzymes binds to its substrate → forms an enzyme-substrate complex.

↳ **Enzymes are required in minute amt. and remain unchanged at the end of reactions.** (dh unlimited resources)
- ↳ Remain unchanged → The same molecules can be used over and over again. → (Save resources.)
- ↳ Small amt. of an enzyme can catalyse the reaction for a large amt. of substrate.

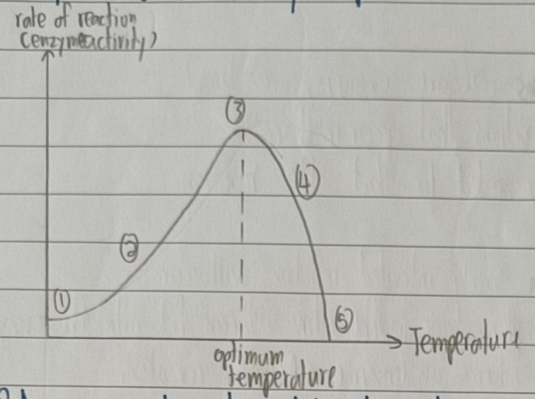
↳ **Denaturation: the change in the three-dimensional structure of an enzyme or any other soluble protein, caused by heat or chemicals such as acids or alkalis.**
- ↳ Substrate can no longer fit into the enzyme's active site, and no reaction will occur.

→ Enzymes of the digestive system

Region of Digestion	PH	Secretion	Source	Enzyme	Action
Mouth	PH7	Saliva	salivary glands	salivary amylase	starch → maltose
Stomach	PH2	gastric juices	gastric glands	protease	proteins → polypeptides
		bile	liver	-	bile salts emulsify fats
small intestine	pH8			protease	proteins → polypetides
		pancreatic juice	pancreas	pancreatic amylase	starch → maltose
				lipase	fats → fatty acids & glycerol
				lipase	fats → fatty acids & glycerol
		Intestinal enzymes	epithelial cells	protease	polypeptides → amino acids
				maltase	maltose → glucose

No.: Date:

Enzymes are affected by temperature



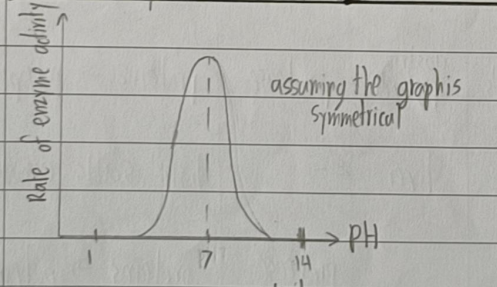
① An enzyme is less active at low temperature
At low temperature, the kinetic energy of molecules is low. Enzyme and substrate molecules more slowly. The rate of the substrate molecules colliding with the enzyme is low.

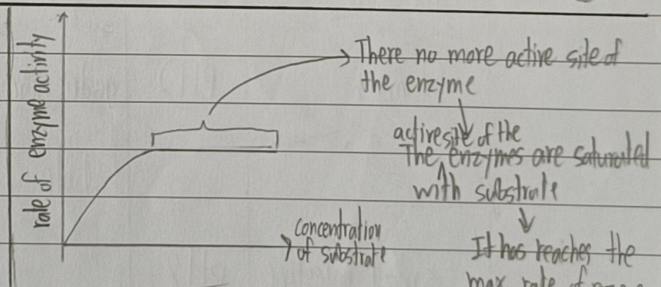
② As the temperature increases, the rate of enzyme reaction increases.
Increasing the temperature increases the kinetic energy of molecules. The rate of effective collision is increased. This increases the rate of enzyme-substrate complex formation.

③ This is the optimum temperature, where the enzyme is most active.
For most human enzymes, the optimum temperature is about 40-45°C.

④ Increasing the temperature above optimum causes a rapid decrease in the rate of ~~enzmy~~ enzyme reaction.
The active site of the enzyme molecules begins to lose its original shape and is no longer complementary to the shape of substrate molecules.

⑤ At this temperature all the enzyme molecules have been denatured.
Most enzymes are denatured.





→ At pH 7, rate of enzyme activity is maximum as this is enzyme's optimum pH.
→ As pH moves further from pH 7, rate of enzyme activity decreases sharply. When pH moves too far from 7, weak bonds within the enzyme are broken,
→ the enzyme loses the shape of its active site and becomes denatured
→ The substrate can no longer fit into the active site, hence enzyme activity decreases sharply until 0.

No.: Date:

Questions

Q: Explain Explain how the rate of an enzyme-catalysed reaction may be affected by increasing temperature. [4]

A:- As the temperature increases from low until the optimum temperature, kinetic energy of enzyme and substrate molecules increases, increasing the chance of effective collision.
This allows
- Enzyme-substrate complexes to form faster, and react rate of reaction increases until the optimum temperature, where rate is the highest.
- As temperature increases beyond optimum temperature, the active site of the enzyme molecules begins to lose its original shape and is no longer complementary to the shape of substrate molecules. Therefore, enzymes starts to denature and ROR decreases sharply to 0.
- Hence, the enzymes are fully denatured when the rate of reaction is at 0.

Q: Biological washing powders (detergents) contain one or more enzymes. Suggest the advantages of using biological washing powders compared to those without enzymes.

A: - It helps to save time as biological catalysts, to speed up reactions for breaking down stains that would otherwise take a long time.
- It also save money and resources as enzymes remain chemically unchanged after the reaction, so. Hence, only a small amount of biological washing powder is required.
- Since enzymes are specific, only the intended reaction of breaking down the stain will occur. Unintended reactions such as breaking down of the dyes of clothes will not happen.

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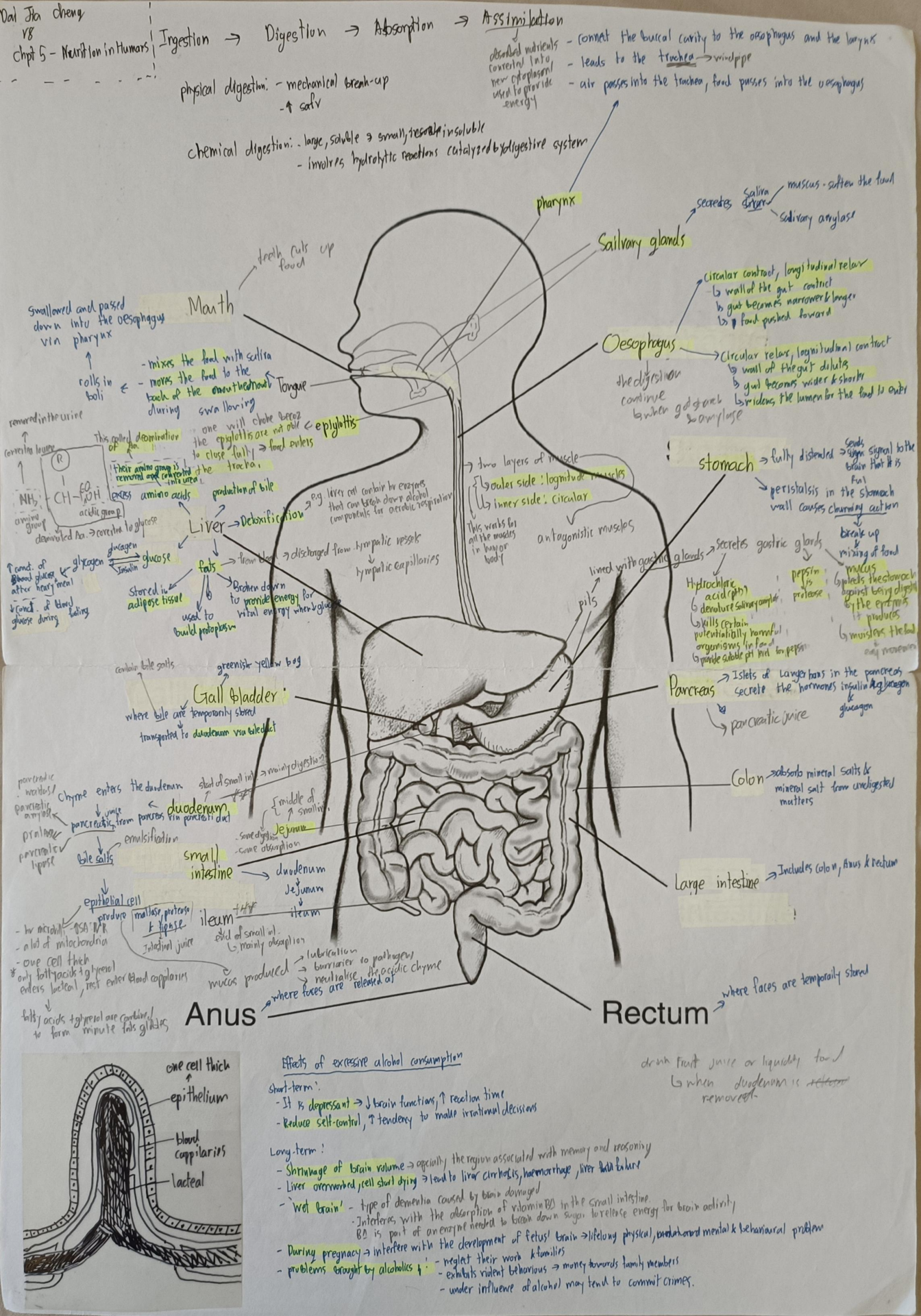
r8
Chpt 5 - Nutrition in Humans

Ingestion → Digestion → Absorption → Assimilation

physical digestion: - mechanical break-up
- ↑ surface area

chemical digestion: - large, soluble → small, insoluble
- involves hydrolytic reactions catalyzed by digestive enzymes

absorbed nutrients converted into new cytoplasm/ used to provide energy



Effects of excessive alcohol consumption

Short-term:
- It is depressant → ↓ brain functions, ↑ reaction time
- Reduce self-control, ↑ tendency to make irrational decisions

Long-term:
- Shrinkage of brain volume → especially the region associated with memory and reasoning
- Liver overworked, cell start dying → lead to liver cirrhosis, haemorrhage, liver failure
- 'Wet brain' - type of dementia caused by brain damaged
  - Interferes with the absorption of vitamin B1 in the small intestine.
  - B1 is part of an enzyme needed to break down sugar to release energy for brain activity
- During pregnancy → interfere with the development of fetus' brain → lifelong physical, emotional and mental & behavioural problem
- problems brought by alcoholics ↓
  - neglect their work & families
  - exhibits violent behaviours → money towards family members
  - under influence of alcohol may tend to commit crimes.

drink fruit juice or liquidity food
↳ when duodenum is ~~reflected~~ removed

Chpt 6

transport : - Blood cells
- nutrients
- excretory products → e.g. CO_2
- hormones from endocrine glands to target organs

contain : - water
- substances such as glucose, protein, Na^+, vitamins, hormones, & excretory products such as urea
- red and white blood cells, antibodies

Blood are separated into its components. e.g. RBC, plasma, platelets for transfusion.

Plasma → forms 60% of blood
- yellowish liquid

Main component in the blood

Red Blood cell
adaptations :
- Circular, biconcave
- ✗ nucleus
- contain haemoglobin
- flexible

haemoglobin + O_2 → (inlurys) → Oxyhaemoglobin (bright red)
Haemoglobin (purplish-red)
the conversion depends on the concentration of the tissue

Blood type group

Blood Gp	A	B	AB	O
Antigen	A	B	AB	don't have
Antibody	B	a	don't have	ab

Take note of !

Recipient	Antibodies in plasma
Donor	Antigens on RBC

- Universal acceptor : AB
- Universal donor : O

Agglutination of RBC
antigen
antibody
(certain antigen binds with specific antibodies e.g. Antigen A with antibody a, Antigen B with antibody b)
There will be clumping because certain type of antibodies react with certain type of antigen

Platelets
fragements of cytoplasm

functions → prevent → the clot seals the wounds
- prevent excessive loss of blood
- prevent foreign particles from entering the blood stream.

How does blood clot?
Blood + Exposed to air
platelets → platelets convert soluble fibrinogen (protein) to insoluble threads of fibrin, involving thrombin
Fibrin threads entangle blood cells and the whole mass forms a clot or a scab.

(soluble) fibrinogen → (thrombin (enzyme)) → long fibrin thread (insoluble)

White blood cell
Lymphocyte - produce antibodies
- recognise pathogens
- destroy disease-causing organisms
- cause bacteria to clump tgt for easy ingestion by phagocytes.
- neutralise the toxins produce by bacteria

nucleus (circular)

Phagocytes → perform phagocytosis → WBC engulfs and destroy foreign particles

cytoplasm, nucleus, many small vesicles, cell membrane

infectious diseases

Organ transplant
transplanted organ may be treated as foreign body by the recipient's immune system
WBC may produce WB antibodies to destroy the transplanted organ → lead to tissue/organ rejection
To prevent WBC from producing antibodies, the recipient have to consume immunosuppressive drugs.
weaken immune system

wldn't happen rejection if from the same person
↳ E.g. a person suffers from burns to the skin, skin from an undamaged area on the same person can be used to replace the damaged skin.

→ muscular wall that separates right & left side of heart

→ prevents the mixing of deoxygenated blood with oxygenated blood in the right side → Max. amt. of oxy. is transported to the body

→ Both ventricles

→ thicker muscular wall compared to atrium

→ left side has a thicker walls than the right side → left side has to pump blood to the rest of the body, while right side pumps blood to lungs.

→ Both atrium

→ receive blood from the veins

→ Hv comparatively thin muscular walls → only force blood into ventricle that lie directly above them → require ↑ pressure

Highest pressure
Artery → Arteriole → capillaries → venules → veins
Lowest pressure.

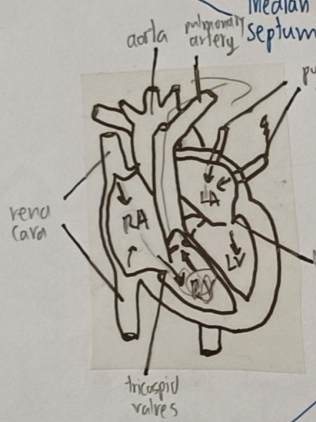
Capillaries
- ppm → one cell thick → ↓ distance for diffusion
- Numerous branches → ↑ surface area → ↑ rate of diffusion
- Lower pressure → ↓ blood flow → ↑ time for exchange subs.
- Continuous blood flow → maintain steep conc. gradient

Arteries
- Thick muscular wall and elastic wall → ↑ pressure in the blood (maintain + withstand)
- Elastic wall → allow stretch & recoil
- able to contract & relax → direct blood to certain organs at certain times
- Smaller lumen compared to vein

Veins
- have valves → ↓ pressure → ✗ back flow
- Thin walls → lesser muscular layer → no need to withstand ↑ pressure
- Bigger lumen compared → ↓ b.p. → need skeletal muscle

Ventricles
Atria
Coronary - Heart
Hepatic - Liver
Pulmonary - lungs
Renal - Kidney

Structure of heart



Blood circulation

Vessels

Colourless liquid → tissue fluid

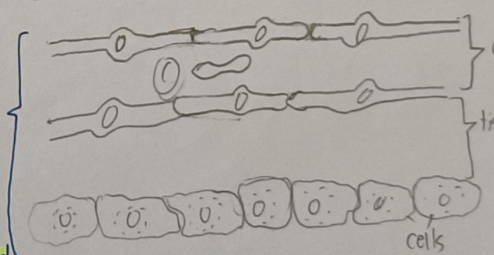
Answer format for cardiac cycle
→ Blood enters the heart
1. Atria diastole
2. Blood flows into the atria → ↑ in pressure in atrium
3. Atria contract
4. forces atrioventricular valves to open
5. Bloods enters ventricle
→ Ventricles contract!
6. as atrium diastole
7. Atrioventricular valves close
8. Semi-lunar valves open
9. Bloods flows into aorta or pulmary artery
10. semi-lunar close

Cardiac Cycle → systole - contraction
diastole - relaxation

- Closure of bicuspid & tricuspid → produce a 'lub' sound
- Closure of semilunar → produce a 'dub' sound

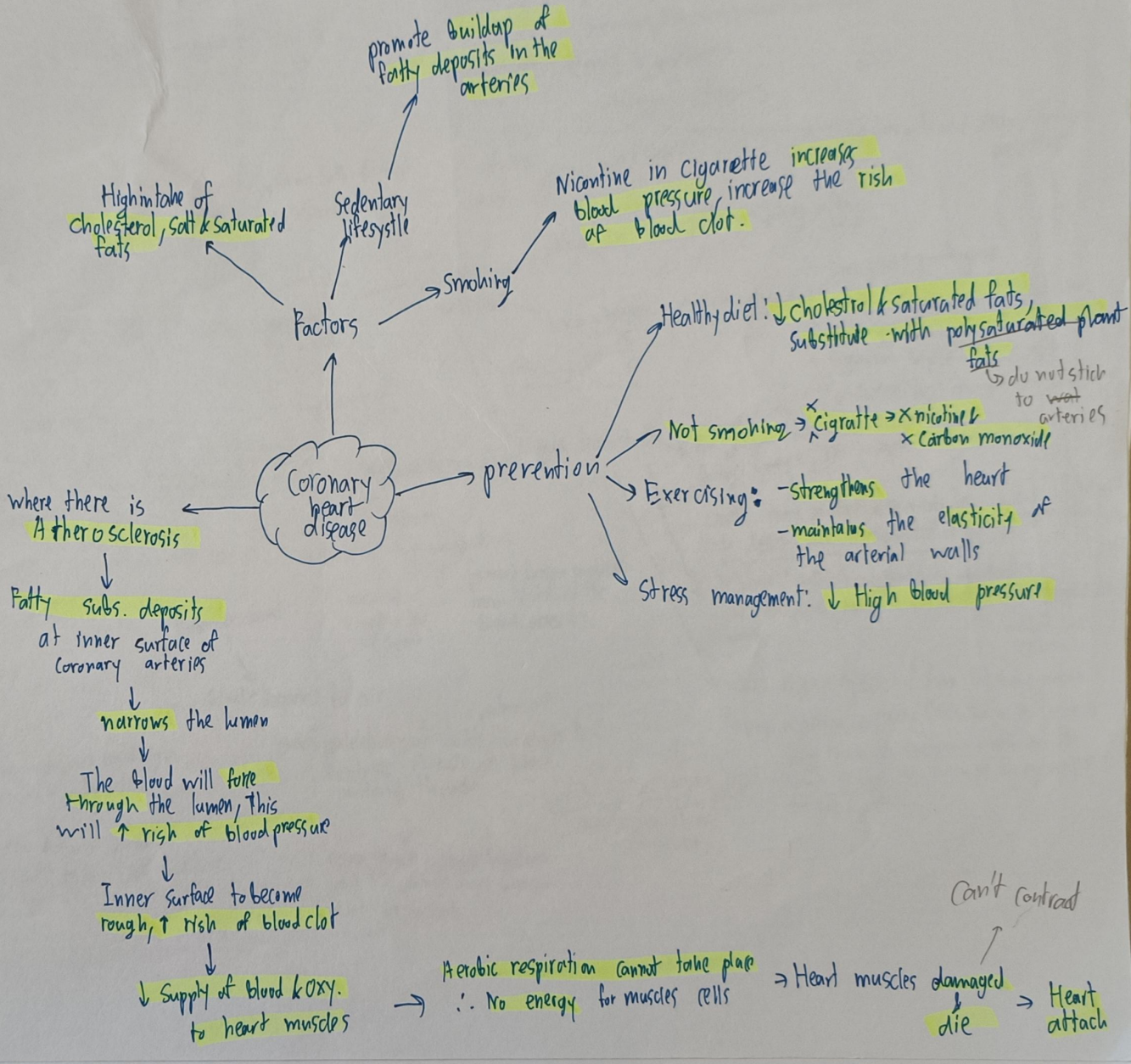
flow of subs.

bloods are constantly moving → ensure ↑ conc. of O_2 in blood, ↓ conc. of O_2 in tissue fluid → steep conc. gradient → ↑ rate of diffusion



∴ Flow of dissolved food subs. & oxy. : diffuse from blood → blood capillary → tissue fluid → cell.

Flow of wasted products from cell: cell → tissue fluid → blood → blood capillaries → blood.


promote buildup of fatty deposits in the arteries
High intake of cholesterol, salt & saturated fats
Sedentary lifesystle
Nicontine in cigarette increases blood pressure, increase the risk of blood clot.
Factors
Smoking
Coronary heart disease
prevention
Healthy diet: ↓ Cholestrol & saturated fats, substitude with polysaturated plant fats
do not stick to arteries
Not smoking
cigratte → ✕ nicotine & ✕ carbon monoxide
Exercising: -strengthens the heart -maintains the elasticity of the arterial walls
Stress management: ↓ High blood pressure
where there is Atherosclerosis
Fatty subs. deposits at inner surface of coronary arteries
narrows the lumen
The blood will force through the lumen, this will ↑ risk of blood pressure
Inner surface to become rough, ↑ risk of blood clot
↓ Supply of blood & oxy. to heart muscles
Aerobic respiration cannot take place ∴ no energy for muscles cells
Heart muscles damaged
Can't contract
die
Heart attach

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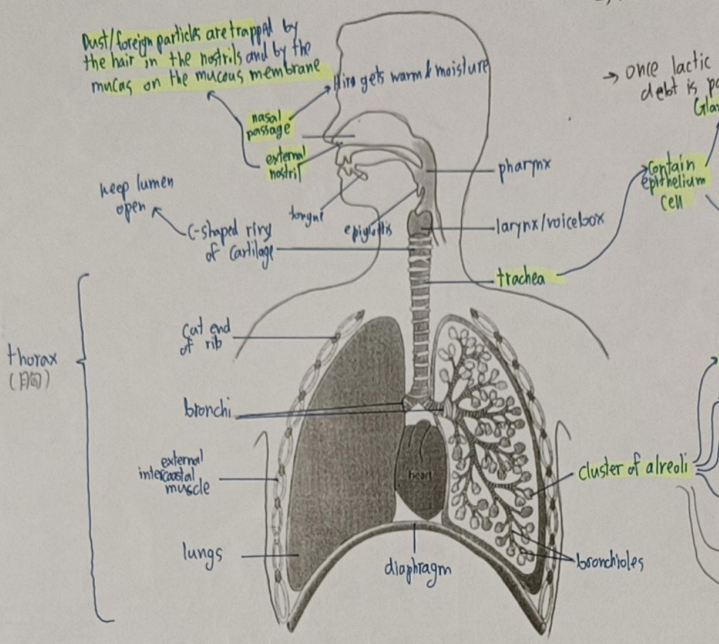
v8

Aerobic respiration → release large amt. of energy
→ breakdown of glucose in the presence of oxy.
→ CO_2 & H_2O are released as waste products
→ Glucose + oxy. → carbon dioxide + water
→ $6C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
→ take place in mitochondria

Anaerobic respiration → release small amt. of energy
→ Breakdown glucose in the absence of oxy.
→ Glucose → Lactic acid toxic substance → cause pain & damage in cell
→ takes place in muscle cell

oxy. debt → amt. of oxy. required to remove lactic acid
→ what take place to pay oxy. debt → continues of ↑ heart rate
→ continuation of deeper & faster breathing
→ once lactic acid is removed from the liver, the oxy. debt is paid.

Flow of air
↓
External nostril
↓
Nasal passage
↓
pharynx
↓
larynx
↓
Trachea
↓
bronchi
↓
bronchioles
↓
Alveoli
↓
blood capillary
↓
RBC
↓
Heart

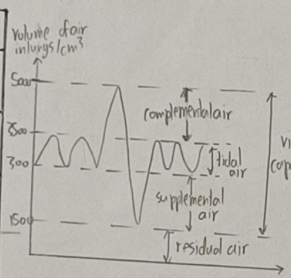


Contain epithelium cell
- Glands cells → secrete mucus to trap dust particles & bacteria
- Ciliated cells → have hair-like structures called cilia on their surface → sweep the dust-trapped mucus up the trachea

cluster of alveoli
- numerous alveoli → ↑ surface area
- one cell thick wall → ↓ diffusion distance → ↑ rate of diffusion
- richly supplied with blood capillary → flow of blood maintain conc. Grad. of gases
- thin film of moisture → oxy. able to dissolves → diffuse through the wall and the wall of blood capillary into RBC
- elastic → can be stretched during inhale
- spherical shape → ↑ SA:V

~~Breathin~~ Breathing in	Breathing out

Event	Inspiration	Expiration
Diaphragm	contracts & flattens downwards	Relaxes & upwards
Intercostal muscles	RICE	ERIC
Ribcage	Moves up & out	moves down & in
Sternum	moves up ~~and~~ forward	moves down to its original position
Thoracic volume	Increases	decreases
lung	Expand	decreases
Air pressure in lung	Lower than atmospheric pressure → air move in	higher than atmospheric pressure → air moves out



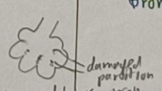
Chemicals in tobacco smoke	Effects
Nicotine (addictive)	→ ↑ heartbeat rate & blood pressure → ↑ the risk of blood clot in the arties → ↑ risk of coronary heart disease → Atherosclerosis must happen before blood clot → ↑ risk of arteries to harrow.
carbon monoxide	→ binds permanently with haemoglobin → ↓ ability to transport oxy. → ↓ haemoglobin available to transport oxy. → ↓ oxygen carrying capcity of blood ↓ → body cell experience more difficulty in obtaining sufficient oxy. from blood. → ↑ risk of coronary heart diseases
Tar	→ cause uncontrolled cell division → ↑ risk of cancer in the lungs → ↑ risk of chronic bronchitis & emphysema → paralyses the cilia lining the air passages → dust particles trapped in the mucus lining cannot be removed

haemoglobin + carbon monoxide → carboxyhaemoglobin

Chronic bronchitis + emphysema → Chronic obstructive lung disease

chronic: long-term
bronchitis: inflammation

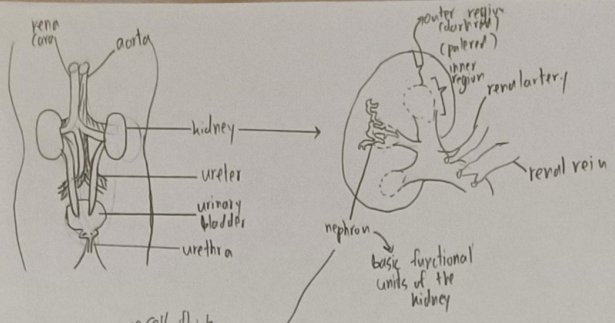
Diseases	Cause	effects
Chronic Bronchitis	Prolong exposure to irritants	~~Infla~~ Inflamed linings of bronchus secrete excessive mucus → Cilia on cells of linings become paralysed → dust-trapped mucus cannot be removed → blocked airways → persistent coughing → lung infections
Emphysema	Persistent & violent coughing due to bronchitis	breakdown of partition walls of ~~alveoli~~ alveoli → ↓ surface area for gaseous exchange → ↓ elasticity of lungs → lungs becomes inflated → Breathing difficult → wheezing & severe breathlessness
Lung Cancer	smoking tobacco	uncontrolled division of cells producing outgrowths or lumps.



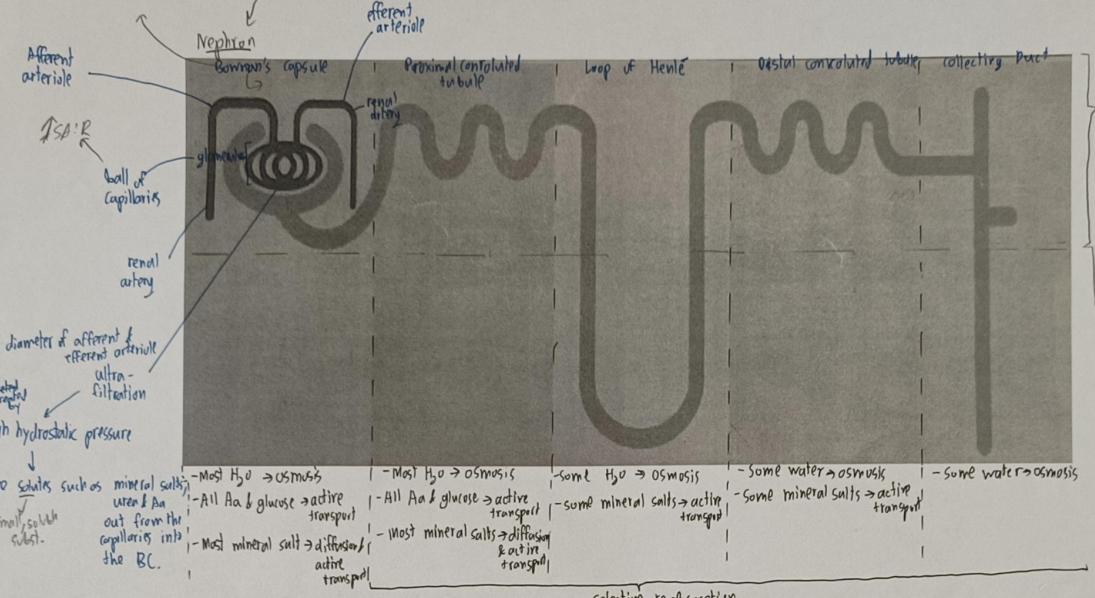
Excretion → the process by which the body removes metabolic waste products & toxic materials
↳ harmful to the body

Dai Jiacheng r8 chpt 8

Excretory Products	Excretory Organs	Excreted As
CO_2	Lungs	expired air
Excess mineral salts	kidneys skin	urine sweats
Excess H_2O	kidneys skin	urine sweats
urea	kidneys skin	urine traces in sweat



one cell-thick



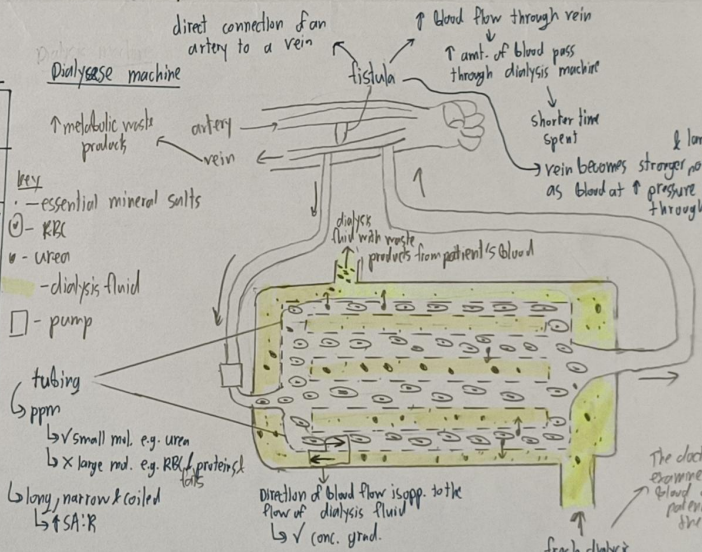
Osmoregulation is the control of wp and solute conc. in the blood to maintain a constant wp in the body.

Stimulus	Wp of blood ↑	Wp of blood ↓
Receptor	Hypothalamus stimulated	Hypothalamus stimulated
corrective mechanism	→ less ADH released by pituitary glands into the bloodstream → Less ADH transported to the kidneys	→ More ADH released by pituitary glands into the bloodstream → More ADH transported to the kidneys
	→ cells in the walls of the collecting ducts becomes less permeable to water → ↑ water excreted → urine more diluted → ↑↑ urine produced	→ cells in the walls of the collecting ducts becomes more permeable to water → ↓ water excreted → urine more concentrated → ↓ urine produced
Reverse effect	Wp of blood ↓ back to normal level	Wp of blood ↑ back to normal level

Antidiuretic hormone (ADH)

purpose of regulating wp:
→ The composition of blood plasma & tissue fluid need to be kept within narrow limits so that the wp of cells is kept constant
→ Changes in wp affect body cells.
→ cells will either crenate or burst in solutions with w.p. diff. from that in the plasma / tissue fluid.

Dialysis machine



key
- - essential mineral salts
- ⓡ - RBC
- ω - urea
- - dialysis fluid
- □ - pump

tubing
↳ ppm
↳ ✓ small mol. e.g. urea
↳ ✗ large mol. e.g. RBC, proteins & fats
↳ long, narrow & coiled
↳ ↑SA:R

common cause of kidney failure:
→ high ρ blood pressure
→ diabetes
→ alcohol abuse
→ severe accidents that physically damage the body kidney
→ complications from undergoing major surgery.

dialysis → 2-3 time/week
→ 3-5 hours/session

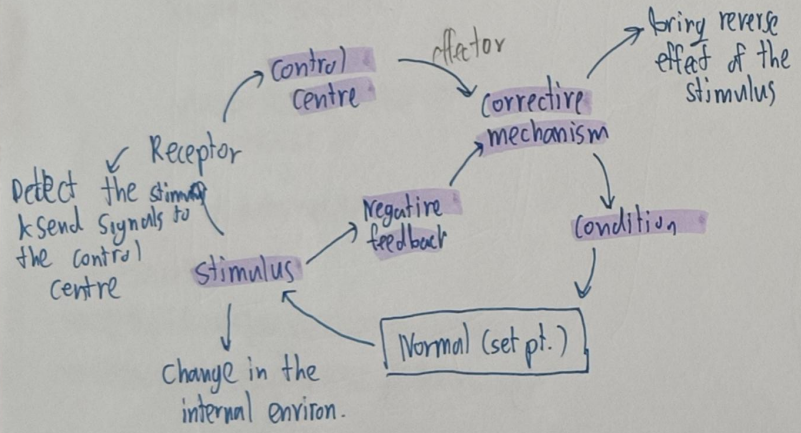
→ ↳ same conc. of essential subs. as healthy blood
↳ ✗ diffuse of essential subs. out
↳ ✓ diffuse of essential subs. in to blood, if patient's blood lack
→ ✗ metabolic waste
↳ ✓ conc. grad.
↓
removal of waste products
↓
- maintain ✓ solute composition & ✓ wp of blood

Chpt 9 - DJC - E8

Homeostasis

↳ The maintenance of a constant internal environment

↳ Examples: → Body temp.
→ w.p. of blood & tissue fluid
→ Blood glucose conc.



Negative feedback: A sequence of events that happen to restore the system to its original state when the system is disturbed.

Hormone :

definition { → Chemical subst. produce in minute quantities by an endocrine glands
→ Transported in the bloodstream to target organ where it exerts its effect
→ After performing their functions → destroyed in the liver
→ excreted by the kidney
→ Alters the activity of one or more specific target organ

Exocrine gland v.s. Endocrine gland

↳ hv a tube/duct to carry their secretion away

↳ E.g. Salivary glands
↳ Salivary duct

↳ DH duct
↳ Directly secreted into bloodstream

↳ E.g. Pituitary glands
↳ Secrete ADH directly into bloodstream

→ Both endocrine & exocrine gland : Pancreas
↳ Hv pancreatic duct to carry pancreatic juice to duodenum

↳ Islets of Langerhans secrete Insulin & glucagon into bloodstream

Insulin

Lack of secretion:

→ muscle cells hv no reserves of glycogen, the body grows weak & continously lose weight

→ glucose not stored by tissue cells

↓

↑ glucose conc.

↓

glucose found in the urine

↓

diabetes mellitus

oversecretion:

→ ↓ blood ~~for~~ glucose conc. → shock

→ Seizures / collasping may follow

Function:

→ ↑ permeability of the C.M. to glucose
∴ glucose is absorbed more quickly

→ ↑ oxidation of glucose during aerobic respiration

→ Conversion of excess glucose to glycogen for storage in the liver & muscle

Glycagon

Function:

→ Conversion of fats & A.a into glucose

→ conversion of stored glycogen back to glucose

Regulation of Blood glucose conc.

above normal → Islets of Langerhans in the pancreas is stimulated → ↑ Insulin is secreted into the bloodstream → Blood transports the Insulin to the liver & muscles → Blood glucose conc. ↓ → feedback to the receptor to reduce insulin production

Below normal → Islets of Langerhans in the pancreas is stimulated → glycagon is secreted into the bloodstream → Blood transport the glycagon to the liver & muscle → Blood glucose conc. ↑ → feedback to the receptor to ↓ glycagon production

glucogen
glycogen
glucose

Take note:

→ Describe the function of Insulin & glycagon.

Insulin injection → dangerous without consuming food
↳ person might faint / fall into a coma
↳ Blood glucose conc. too low + cells lack glucose for aerobic respiration.

Diabetes Mellitus

↳ Body is unable to control its blood glucose conc.

↳ glucose conc. too high
↓
kidney can't reabsorb all glucose
↓
urine got glucose

→ Type 1 diabetes (Jurenile/early-onset diabetes)
↳ Islets of Langerhans can't produce sufficient insulin
↳ Insulin injections ***

→ Type 2 diabetes (Late-onset diabetes)
↳ Target organs such as liver & muscle lose sensitivity to insulin
↳ Treatment:
↳ Diet lower in carbohydrates
↳ Exercise regularly
↳ Inject insulin / take medication
↳ ↑ body's sensitivity to insulin

→ Signs & symptoms
↳ Persistent ↑ blood glucose lvl
↳ presence of glucose in urine
↳ Frequent urination
↳ Frequently feeling dizzy, fatigue
↳ Unexpected weight loss → ✗ insulin → ✗ more glucose into the body's cells
↓
✗ glucose used
↓
body start burning fat & muscle for energy
↳ Wounds take longer to heal
↳ blood flow ↓ → ↓ deliver nutrient

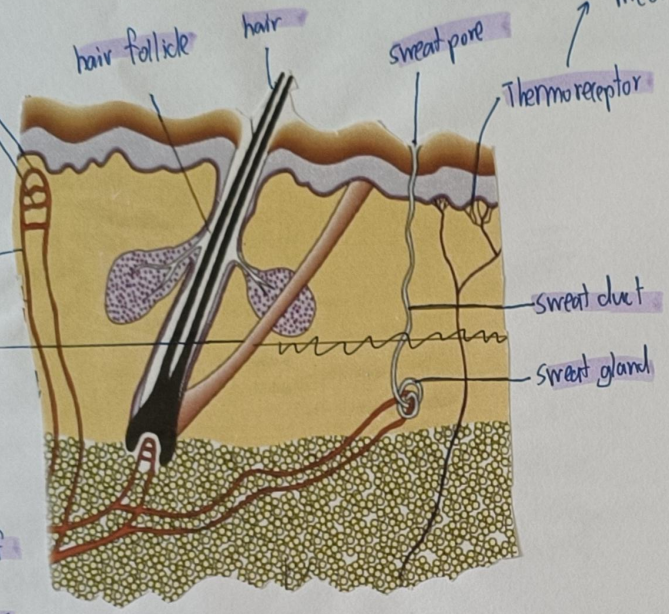
glucose built in the bloodstream
↓
kidney remove it.

→ Risk factors of type 2 diabetes
↳ Obesity / overweight
↳ Age
↳ Family history → Inherited
↳ Sedentary lifestyle
↳ Unhealthy ~~life~~ blood lipid levels

→ Prevention
↳ Exercise regularly, maintain healthy weight
↳ Eat balanced, healthy diet, low in calories & ↑ in fibre
↳ ∴ improving blood lipid levels

→ Hypothalamus monitors & regulate body temp

detect changes & initiate self-corrective mechanism



→ Stimulus → body temp

↳ above normal

↳ below normal

Detected by the thermoreceptors in the skin & hypothalamus is stimulated

lies flat ↑ too hot

hair erector muscle (HEM)

↳ when too cold, HEM contract, hair stand up

↓

trap a thin layer of air

↓

poor conductor of heat

↓

↓ heat lost

→ Arterioles in the skin dilate

↳↑ blood flow thru. B.C.

↓

↑ heat loss via ~~skin~~ radiation / convection

→ Arterioles in the skin constrict

↳↓ blood flow thru. B.C.

↓

↓ heat loss via skin

→ Sweat glands

↳ More active

↳↑ production of sweat

↓

↑ evapo.

↓

↑ heat loss from skin

→ Sweat glands

↳ less active

↳↓ production of sweats

↓

↓ evapo.

↓

↓ heat loss from skin

→ Metabolic rate ↓

↓

↓ heat release in body

→ Metabolic rate ↑

↓

↑ heat ~~realse~~ released in body

Way of heat gain by body:

→ rigorous muscular exercise

→ consumption of hot food

→ Being in warm environment

Way of heat loss by body:

→ Through skin surface via convection, radiation & conduction

→ evapo. of sweat

→ ~~Fares~~ Faeces & urine

→ Air exhaled

vasodilation: skin turn red

vasoconstriction: skin turn pale

After exercise

↳ wipe the sweat away first → so that the residue such as salt is left on the skin will be cleared away

↳ ∴ allow new sweat to be released

↳ allowing us to cool down faster.

↳ stand under fan afterwards

moisture on the skin removed

↓

↑ efficient evaporation

→ Shivering

↳ rapid contraction & relaxation of the skeletal muscle

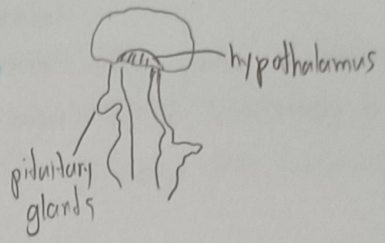
↓

↑ rate of aerobic respiration

↓

↑ heat released in the body

Osmoregulation is the control of w.p. & solute conc. in the blood to maintain a constant w.p. in the body



Antidiuretic hormone (ADH)

stimulus → w.p. of blood

Increase → osmoreceptor detect the w.p. in Hypothalamus stimulated

decrease → osmoreceptor detect the w.p. in Hypothalamus stimulated

→ less ADH released by pituitary glands into the bloodstream
→ less ADH transpored to the kidney

→ cells in the walls of the collecting ducts becomes less permeable to water
↓
- ↑ water excreted
- urine more diluted
- ↑ urine produced

→ Reverse effect → w.p. of blood ↓ back to normal

→ More ADH released by pituitary glands into the bloodstream
→ More ADH transported to the kidney

→ cells in the walls of the collecting ducts becomes more permeable to water
↓
- ↓ water excreted
- urine more conc.
- ↓ urine produced

→ w.p. of blood ↑ back to normal

purpose of regulating w.p.:
→ The composition of blood plasma & tissue fluid need to be kept within narrow limits so that the w.p. of cells is kept constant
↓
w.p. Affecting body cell.
↓
Cells will either crenate or burst in solutions with w.p. as diff. from that in the plasma/tissue fluid.

water lost:
- Urine
- Sweat
- breathing out - thin layer of moisture on the surface of alveoli.
- faeces

chpt 10
Dui Jiachang

ex arc : shortest pathway by which nerve impulses travel from the receptor to the effector in a reflex action

junction bet. two neurones

synapse

The neurones release chemicals that help transmit nerve impulse across synapse → diffusion only

Relay neurone
↳ connects both neurone

Sensitivity
↳ ability to react to changes in its surrounding

terminal nerve fibre

Receptor in the skin
↓
Sensory neurone
↓
Relay neurone in the spinal cord
↓
Brain
} sensation

Short nerve fibre

central nervous system (CNS)
↳ consist of brain & spinal cord

peripheral nervous system (PNS)
↳ ~~consist~~ consist of cranial nerves, spinal nerves & the sense organ

sensory neurone

long nerve fibre → Insulator ↳ prevent nerves impulse lost

Spinal & brain keep ourselves safe ↳ reacts to danger

nerve fibre
↓
a strand of cytoplasm extending from the cell body

Motor neurone

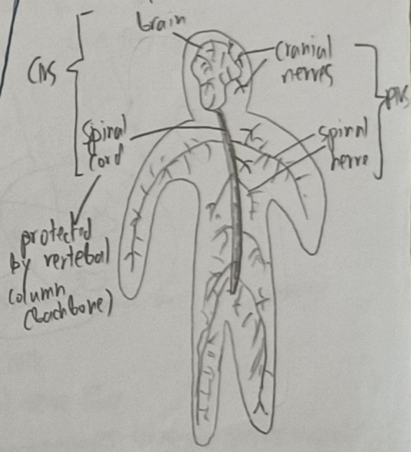
allow nerves impulse to jump from one point to the another

nucleus

cytoplasm

cell body
↳ contain :
- nucleus
- cytoplasm
- Cell membrane
- organelle

protected by skull



Brain
↓
Relay neurone in the spinal cord
↓
motor neurone
↓
Effector
} voluntary action ↓ under conscious control

nerve fibre

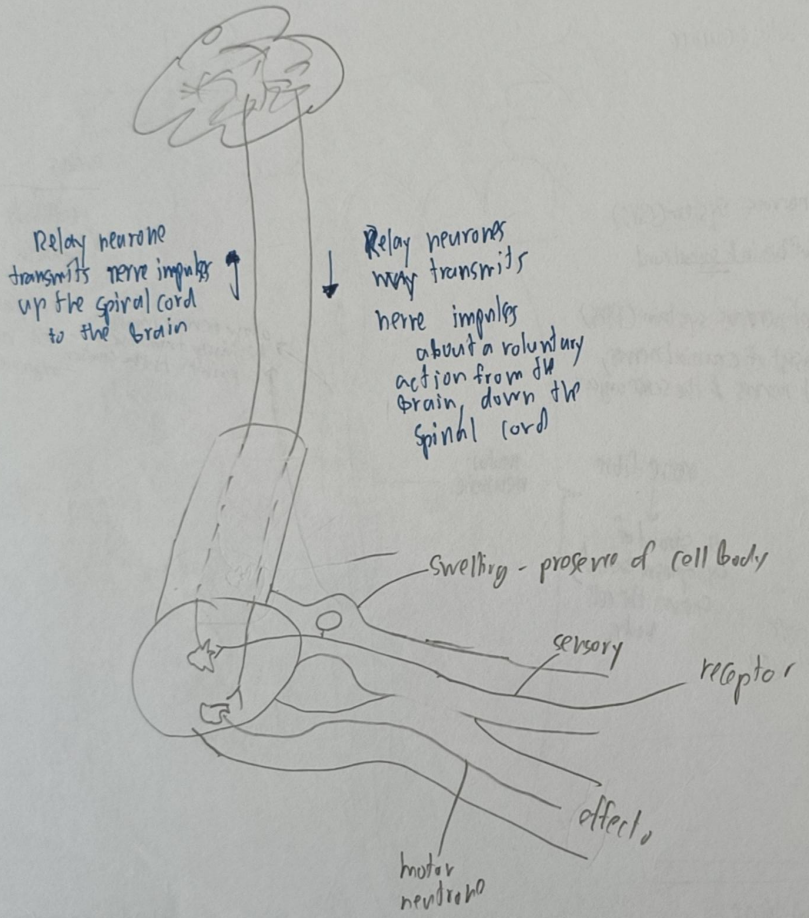
spinal nerve
↳ connect spinal cord to various body parts
↳ contains both sensory & motor neurons.

Identify neurone !
↳ cell body
↳ direction of nerve impulse

sense organ (receptor)
↳ generate nerves impulses

muscle fibres (effector)
↳ glands

Voluntary action



Describe how the neurone above receives impulse

- Nerve impulse from the relay neuron travels across a synapse by neurotransmitters to the motor neurone

(voluntary)

Reflex action: immediate response to a specific stimulus without conscious control

→ 2 groups:

- Cranial reflexes
  - ↳ by the brain
  - ↳ occur in the head region
  - ↳ e.g. pupil reflex, blinking & salivation
- Spinal reflexes
  - ↳ by the spinal cord
  - ↳ e.g. knee-jerk reflex & withdrawl of hand when touching hot object

Endocrine control	Nervous control
Involves hormone as signals	Involves nerve impulse as signals
Hormone are trans. by the blood	Nerve impulse are transmitted by neurone
Response may be short-lived/ long lived	Response are short lived
always involuntary	May be voluntary/involuntary
May affect 1 / more target organ	usually localised

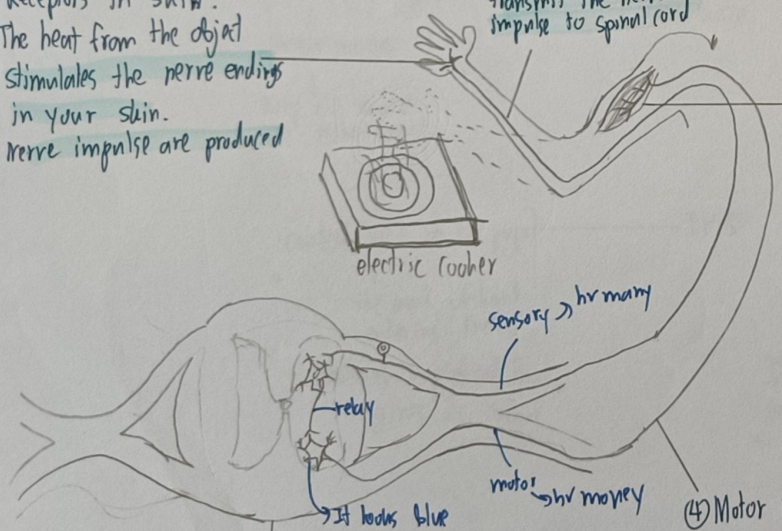
~~conditioned~~ reflex action
↳ voluntary
↳ under conscious control
↳ intentionally on purpose

Stimulus → e.g. heat, light intensity
(cause / result)
response → e.g. move hand away

If there is hard injuries → can't feel the heat
↓
can see/smell
↓
move your own hand

① Receptors in skin:
The heat from the object stimulates the nerve endings in your skin.
Nerve impulse are produced

② Sensory neurone:
The sensory neurone transmit the nerve impulse to spinal cord



③ Spinal cord:
the nerve impulses are transmitted first across a synapse to the relay neurone, & then across another synapse to the motor neurone

④ Motor neurone:
transmits the nerve impulses from the spinal cord to the effector.

⑤ Effector muscle:
Your biceps muscle then contracts & causes the hand to withdraw suddenly

~~Sound~~
the eye can represent what our ear hear.

Similarities bet. nerves cells
↳ all hv nucleus, terminal nerve fibre
↳ All hv cell body
↳ ~~both carry~~ both ~~carry messages~~ transmit nerve impulse

difference
↳ relay is shorter than others
↳ sensory hv a cell body on the ~~fibre~~ nerve fibre
↳ relay dh nerve fibre
↳ only sensory hv a long nerve fibre
↳ sensory & motor hv nerve fibre

1. light → stimulus
2. photoreceptor → detected & send nerve impulse

⋮

Brain interprets the n.I, enabling the person to see

Tear glands & Upper eyelid

secrete tears that:
- wash away dust particles
- keep the cornea moist for atmospheric oxy. to dissolve so that the dissolved oxy. can diffuse into the cornea
- lubricate the conjunctiva, helping to ~~reduce~~ reduce friction when the eyelids move

with blood vessels → need O2 to keep up cellular metabolic needs

eyelashes → sheild eye from dust particles

Conjunctiva (covers sclera)
- a thin transparent membrane covering the sclera infront
- a mucous membrane → secrete mucus → keep the front of the eyeball moist

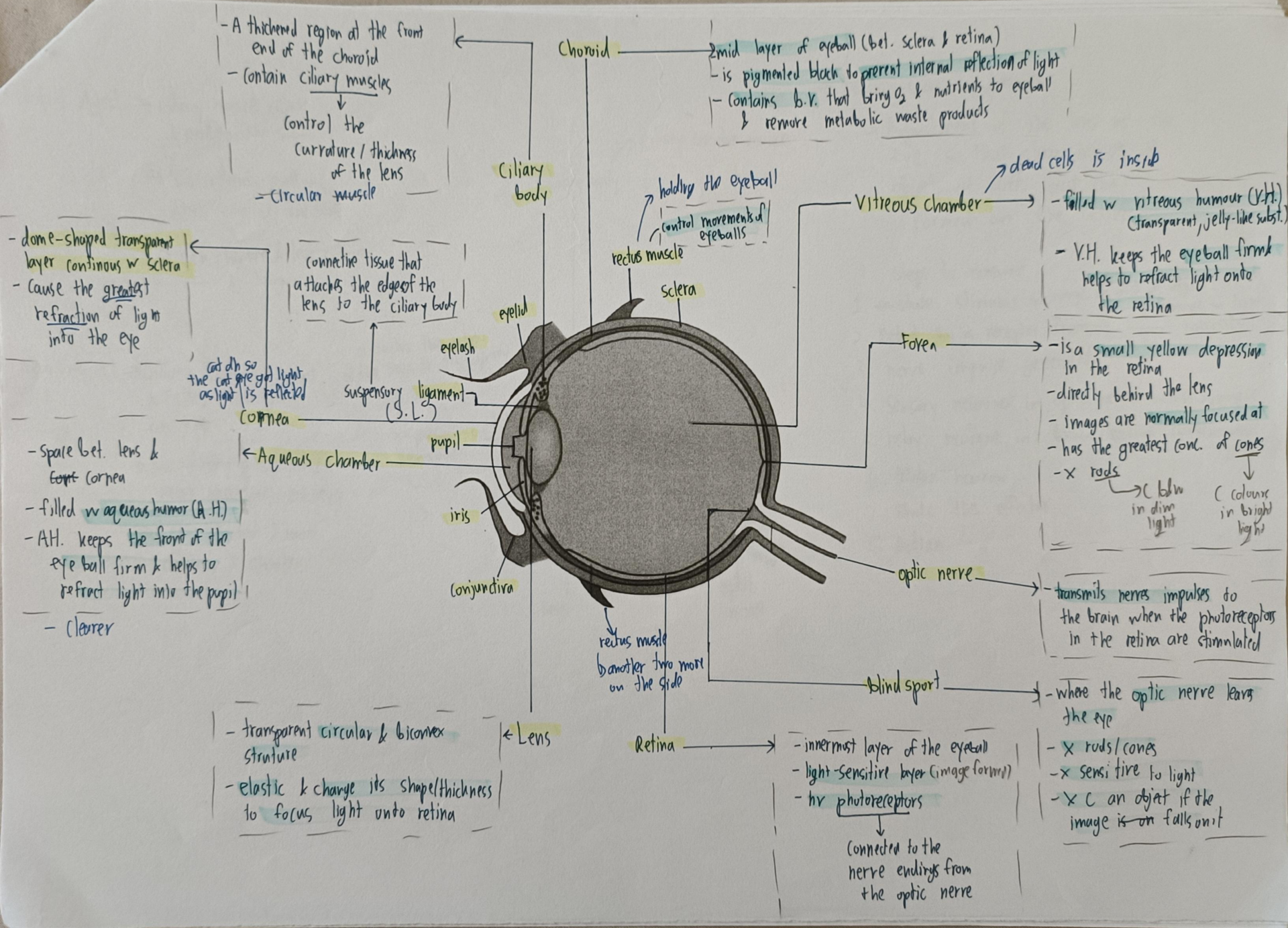
Sclera (sclerotic coat)
- the white of the eye
- continues with the cornea
- dome-shaped transparent layer at the front of the eye
- protect eyeball from mechanical damage.

lower eyelid
- protect cornea from mechanical damage
- partly closed → squinting → prevents too much light from entering the eyelid & damaging the retina
- Blinking spreads tears over the cornea & conjunctiva
- wipes dust particles off the cornea.

Iris
- control size of the pupil → ∴ the amt. of light entering the eye
- contains a pigment that gives its colour

Tear glands
~~will go~~ the tears will go into the nose so it will be stuffy

pupil
allows light to enter the eye


- A thickened region at the front end of the choroid
- contain ciliary muscles
control the curvature / thickness of the lens
- Circular muscle
Ciliary body
Choroid
mid layer of eyeball (bet. sclera & retina)
- is pigmented black to prevent internal reflection of light
- Contains b.v. that bring O_2 & nutrients to eyeball & remove metabolic waste products
holding the eyeball
control movements of eyeballs
rectus muscle
Vitreous chamber
dead cells is inside
- filled w vitreous humour (V.H.) (transparent, jelly-like subst.)
- V.H. keeps the eyeball firm & helps to refract light onto the retina
- dome-shaped transparent layer continous w sclera
- cause the greatest refraction of light into the eye
connective tissue that attaches the edge of the lens to the ciliary body
sclera
eyelid
eyelash
Fovea
- is a small yellow depression in the retina
- directly behind the lens
- images are normally focused at
- has the greatest conc. of cones
- x rods
C b&w in dim light
C colours in bright light
cat's eye so the cat can get light as light is reflected
Suspensory ligament (S.L.)
Cornea
pupil
Aqueous chamber
- Space bet. lens & cornea
- filled w aqueous humor (A.H.)
- A.H. keeps the front of the eye ball firm & helps to refract light into the pupil
- Clearer
iris
Conjunctiva
optic nerve
- transmits nerves impulses to the brain when the photoreceptors in the retina are stimulated
rectus muscle
(another two more on the side)
blind spot
- where the optic nerve leaves the eye
- x rods / cones
- x sensitive to light
- x C an object if the image is on falls on it
Lens
- transparent circular & biconvex structure
- elastic & change its shape/thickness to focus light onto retina
Retina
- innermost layer of the eyeball
- light-sensitive layer (image forms)
- hv photoreceptors
connected to the nerve endings from the optic nerve

distant object → Ciliary muscle relax & pull on the S.L.

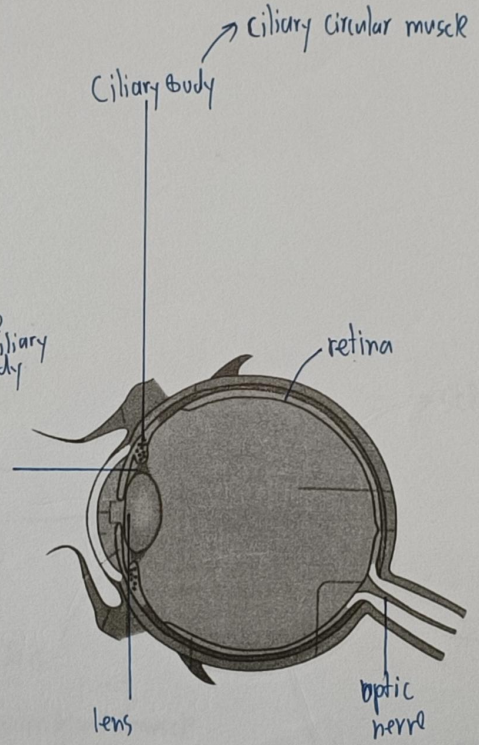
→ S.L. taut, pull on the edge of the lens

→ Len thinner & less convex & longer

Near object → Ciliary muscle contract & relax their pull on the S.L.

→ S.L. ~~taut, p~~ slacken & relax their pull on len.

→ Len thicker & more convex & shorter



→ Focusing (accomodation)

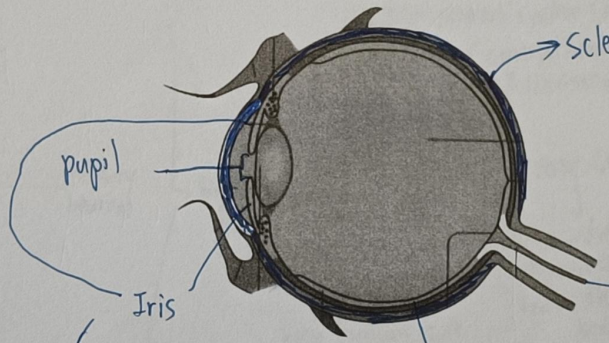
↳ Adjustment of the lens of the eye so that clear images of objects at diff. dist. are formed on the retina.

Steps to answer:

1. → state stimulus → change in dist of object or change in light intensity
2. Detect by a receptor from...
3. nerve impulse generated
4. Sensory neurone in optic nerve across synapse
5. relay neurone in brain / spinal cord across synapse
6. Motor neurone
7. state the effector
8. Action

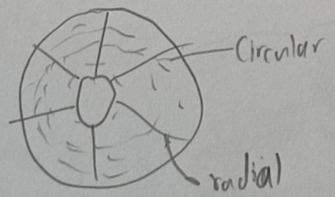
→ Benefits of pupil reflex to the eye:
- automatic → ×learning
- prevents excessive light from entering the eye & damaging the retina
- Immediate response
- allow enough light to enter to eye to allow us to C.

The pupil size also increase when:
- frightened, happy, crying
- So that they can capture as much light (info.) as possible.



→ Sclera → protection
↳ Transparent infront of the eyeball

↳ Circular & radial muscle



Retina → most inner layer
↳ light-sensitive layer
↳ photoreceptor

Pathway of nervous:

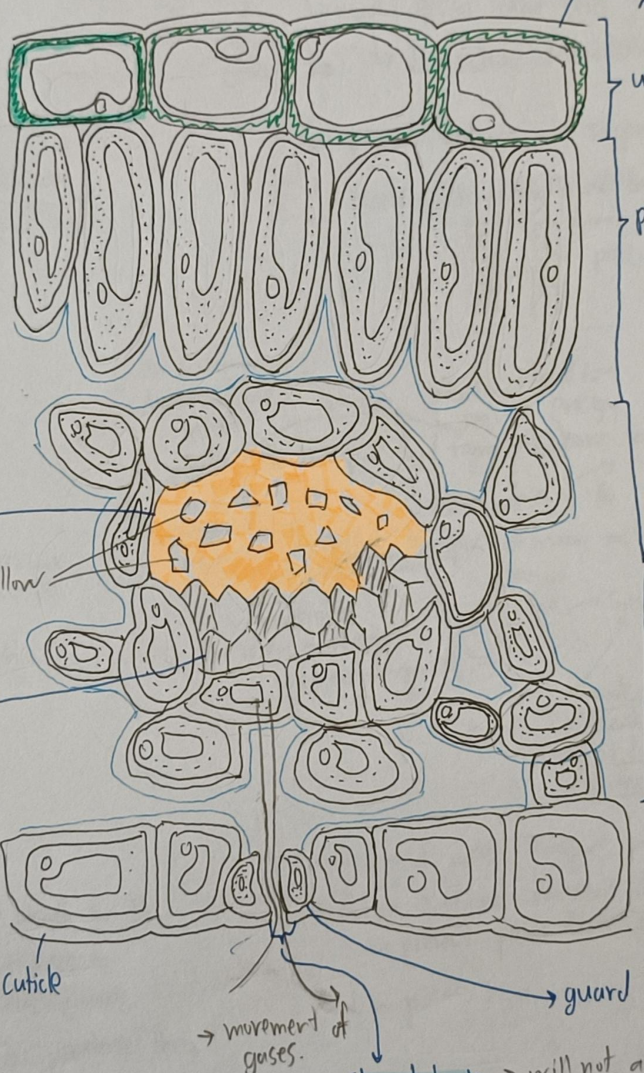
Stimulus → Receptor (in retina) → sensory neurone in the optic nerve → Brain → motor neurone → Effector (iris muscle)

why the pupil take longer to dilate than contract?
→ too much light → damages to photoreceptor cells in the retina

→ Dilates slowly → dim light → × damage

Dai Jia cheng
E8
Chpt 12

drawing of land plant



prevent excessive water loss via evapo. ← waxy ← Cuticle → transparent → allow light to pass thru.

Cuticle ↑ secrete

upper epidermis → contain upper epidermal cells
↓ mechanical protection

Palisade mesophyll tissue
- Consist of 1/2 layers of closely packed, long cylindrical cells
  ↳ absorb as much light
- Specialised for photo. → ↑ conc. of chloroplast

P.S.

exchange of gases

Spongy mesophyll tissue
- cells of irregular shape
  ↳ provide intercellular air spaces
    ↳ store gases → CO_2 & H_2O
    ↳ rapid diffusion
- fewer chloroplast than palisade
  ↳ absorb sunlight that was not trapped by palisade
- covered w a thin ~~film~~ film of moisture
  ↳ allow CO_2 to dissolve in it
  ↳ hv large SA:V
- contains transport tissue
  ↳ vascular bundle

Vascular bundle → transport
- xylem
- hollow
- phloem

lower epidermis
- a layer of closely packed lower epidermal cell
- guard cell → contain Chloroplast
  - regulate rate of transpiration by opening & closing the stoma
  - will not all close bc needed for transportation
    ↳ take in CO_2 for respiration

stomatal pore (stoma) → movement of gases.

(sunny day) lost too much water → flaccid

Cuticle

---

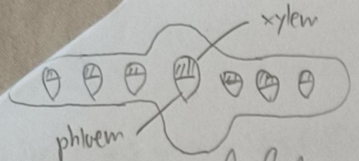
water plant

→ Differences:
- They hv their stomata ~~on~~ at the upper epidermis
- ✗ cuticle at the lower epidermis
  ↳ ✗ hv to prevent excessive water loss
- lower epidermal cells hv chloroplast
  ↳ there is so many air chamber to trap air

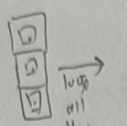
→ Hv air chamber
↳ flotation
↳ trap gaseses

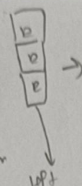
How guard cell works:

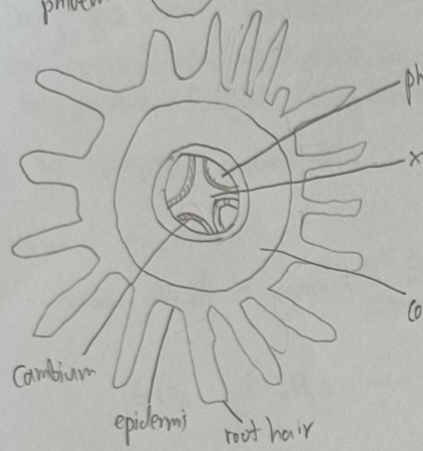
→ guard cells carry out photosynthesis & produce glucose
→ wp. ↓ so H_2O enters via stoma or osmosis
→ Guard cells swell & become turgid
→ They become curved & the stoma opens.



Leaves





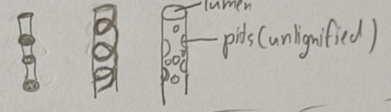


dicotyledenous root (T.S)

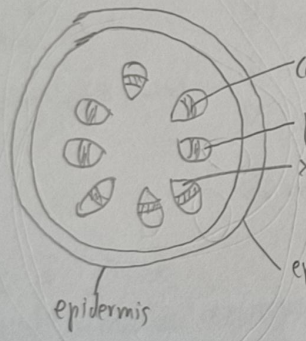
xylem → in a cell pic → the what holes are even
→ one direction

- To conduct water & mineral salts up from the roots
  - ↳ made up of dead cells without cytoplasm/cross-walls
    - ↳ ↓ resistance to water flowing through
  - require energy ↳

- To provide mechanical support to the plant as water flows through → prevent vessel collapse
  - ↳ inner wall strengthened by deposits of lignin



- Root pressure
  - ↳ osmosis
- Capillary action
  - ↳ Surface tension force of the water molecules, move inside very narrow tubes
    - ↳ limited dist. travel
- Transpiration pull (main)
  - ↳ The suction force created due to transpiration that pull water & mineral salts up the xylem
    - ↳ Transpiration
      - ↳ The loss of water vapour from the aerial parts of a plant, mainly thru the stomata of the leaves



vascular bundle

stem

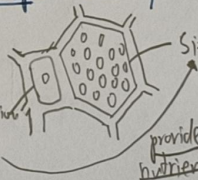
In a cell pic
↳ the holes are uneven

phloem → both direction
require energy

- To transport food from the leaves to other parts of the plant
  - ↳ sucrose, A.G. + nitrate mineral salt to form CO protein
  - ↳ Active transport → many mitochondria in companion cell

insecticide also

must state when answering the question



Sieve tube → contain sieve plates → The 'cross-wall' separate the cells have a lot of pores
↳ Sieve tube cells

provide nutrients & help it to transport manufactured food

Adaptation of leaf shape

- Thin & wide leaf blade → ↑ SA:V → maxi. light absorb for P.S.
  - ↳ ↓ the diffusion dist. for gases to reach mesophyll cells quickly.
  - ↳ allows light to easily penetrate thru. the leaf to reach all mesophyll cells.

Importance of active transport in R.H.C
- ↳ obtain sufficient mineral salts
  - ↳ prevent plant from dying from nutrient deficiency
- ↳ ↓ w.p. → H_2O osmosis
  - ↓
  - remain turgid & x dehydrated

Photosynthesis

↳ The process whereby CO_2 & H_2O are converted into O_2 & glucose, in the presence of light energy & chlorophyll (only absorb trap light)

↳ Oxygen produced first

↳ word equation:

Carbon dioxide + water $\xrightarrow[\text{Chlorophyll}]{\text{light energy}}$ Glucose + oxygen

$$6CO_2 + 6H_2O \xrightarrow{\text{light energy, chlorophyll}} C_6H_{12}O_6 + 6O_2$$

↳ Factors of p.s. : ① light intensity → most impt.

external factor → plants can't control

② Conc. of CO_2

③ temp.

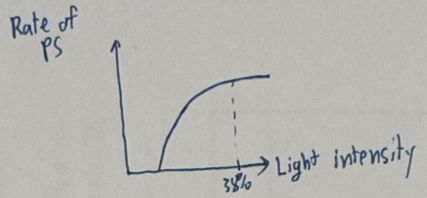
④ presence of Chlorophyll

⑤ water → ensure plant remain turgid

→ Uses of glucose:

- used in aerobic respiration
- Stored as starch for energy storage if excess
- systhesise cellulose → cell wall
- Convert to sucrose → transport
- Convert to A.a. → form protein
  ↳ mineral salt ↳ build new cell parts
  + nitrate
- Convert to fats → storage
  ↳ build new cell parts

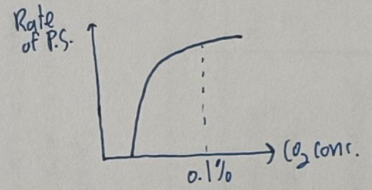
Light intensity



- As LI ↑, the rate of P.S. ↑ until a constant & maximum is reached
- ∴ ↑ light means ↑ energy trapped for P.S.
- B4 3%, LI is limiting factor
- After 3%, LI is no longer limiting factor other is the limiting factor

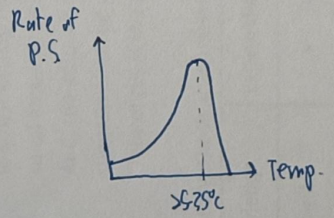
} Answering format.

CO_2 conc.



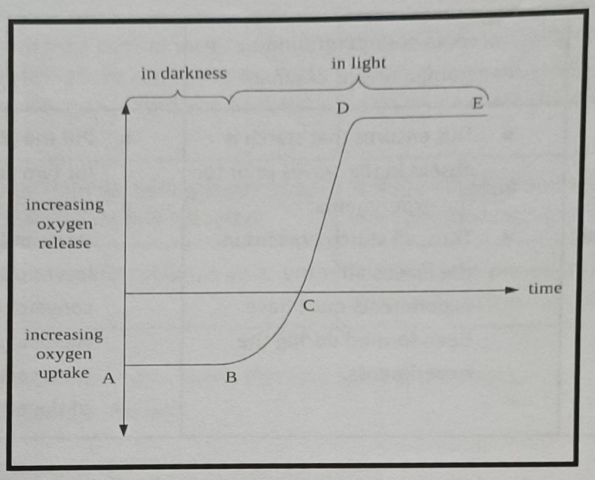
- As CO_2 conc. ↑, rate of P.S. ↑ until a constant & maximum is reached
- ∴ ↑ CO_2 means ↑ glucose can be produced → provide Carbon

Temp. → enzyme



- As temp. ↑ to optimum temp, the rate of P.S. ↑
- As temp. ↑ beyond optimum temp, the rate of p.s. ↓
  ↓ denaturation

use word like steeply, gradually → data to support it



- At point B, there is a decrease in oxygen uptake and an increase in oxygen release. The rate of photosynthesis increases. **Photosynthesis starts at point B**, as soon as the plant starts to release oxygen. This is because oxygen used up per unit time is lower, meaning that some of the oxygen used up by respiration is being offset by small amounts of oxygen produced by photosynthesis.
- At C, the amount of oxygen released is equal to the amount of oxygen absorbed. This suggests that the rate of photosynthesis is equal to the rate of respiration. (Note: ✗ "rate of p/s is the **same as** rate of r/s")

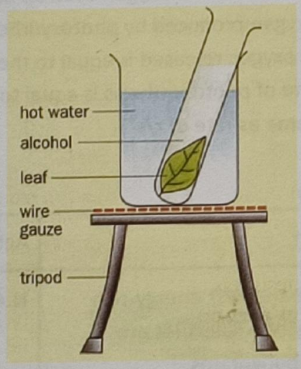
5. Photosynthesis experiments

Basic Knowledge	Explanation	Action to take
Glucose is first formed from carbon dioxide during photosynthesis.	• The simplest energy-rich organic molecules are carbohydrates. • The simplest stable form of carbohydrates are the monosaccharides, e.g. glucose.	N.A.
Presence of starch in the leaves suggests that photosynthesis has taken place.	• When glucose is formed more quickly than it is used up, the **excess glucose** is converted to **starch** for storage. (Under the presence of light, the rate of photosynthesis is higher than the rate of respiration.) • However, starch formation is not photosynthesis – starch can be formed even in the	Test for starch using iodine test.

	roots or underground storage organs of plants.	
De-starching (removal of starch) must be carried out on the plants before the experiments.	• This ensures that starch is absent in the leaves prior to the experiments. • Thus, **all starch present in the leaves** after the experiments must have been **formed during the experiments.**	• Put the plants in the dark for two days. • In darkness, photosynthesis stops and enzymes in the leaves catalyse the **conversion of starch to sucrose**, which is **transported to other parts of the plant.**

a. Factors necessary for photosynthesis

Experiment 1: Test for starch in a leaf:



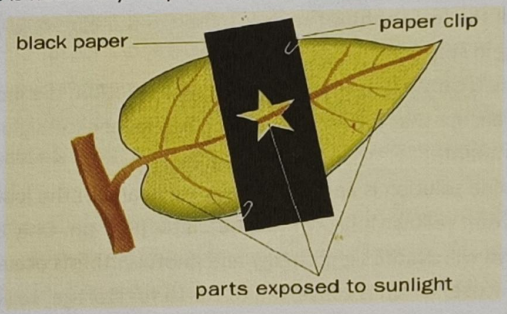
Test on leaf specimen P1.

Step	Action	Purpose
1	Plant containing P1 was placed in a dark room for 48 hours.	To destarch the plant so that any starch present in P1 later is only formed during the experiment.
2	Plant containing P1 was placed under the Sun for 5 hours before P1 was removed from the plant.	To allow the plant to carry out photosynthesis.
3	P1 was placed into a beaker of boiling water.	To denature all enzymes in P1 so that starch formed through photosynthesis is not converted to glucose. The high temperature also destroys the cell membranes of the leaf cells.

4	P1 was removed from the hot water and placed into a boiling tube containing ethanol. The boiling tube is then placed into a beaker of boiling water.	To remove chlorophyll from P1 so that the colour change caused by the iodine solution later will be more easily visible.
5	P1 was removed from the boiling water using a forcep and placed back into hot water.	To soften the leaf and make the leaf cells more permeable to iodine solution.
6	P1 was stained with iodine solution on a white tile.	To test for the presence of starch and observe its distribution in P1.

Observation: The iodine solution turns from yellowish brown to blue-black.
Conclusion: Starch is present in the leaf.

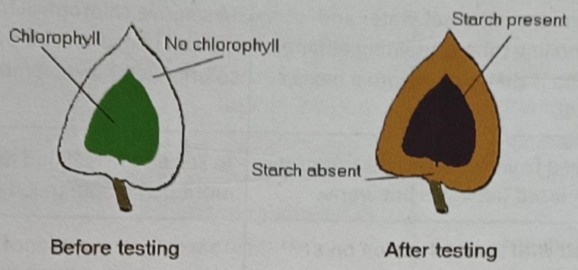
Experiment 2: Test if light is necessary for photosynthesis:



1. Destarch a potted plant by placing it in the dark for two days.
2. Remove one leaf. Test it for starch as described in Experiment 1.
3. Sandwich a leaf, which is still attached to the plant, between two pieces of black paper. Each paper has a certain pattern cut out from it. Fasten the papers with paper clips. Place the plant in strong sunlight.
4. After a few hours, remove the leaf and test it for starch.
5. Make a drawing of the leaf to show the regions that are stained blue-black.
    a. Before the treatment of the leaf with iodine solution, the leaf must be **de-starched**. This is to ensure that the formation of starch from excess glucose occurred during the experiment.
    b. When iodine solution is applied to the parts exposed to light, the iodine solution changes from yellowish-brown to blue-black. (Reason: The chlorophyll in the chloroplasts absorb light energy for photosynthesis, producing **excess** glucose which is converted to starch for storage.)
    c. When iodine solution is applied to the parts that were covered by the black paper, the iodine solution remains yellowish brown. (Reason: The chlorophyll in these parts were not exposed to light, so light energy cannot be absorbed by chlorophyll for photosynthesis to occur.)

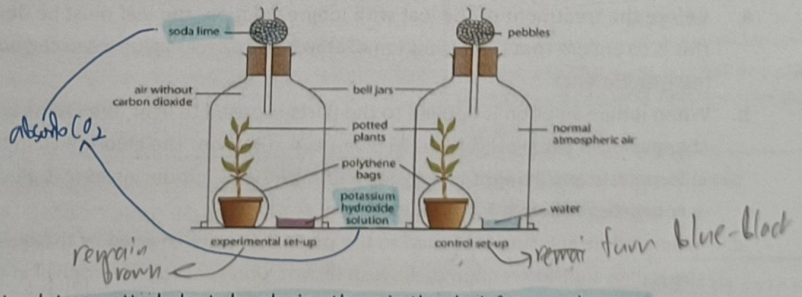
~~Experiment 3: Test if chlorophyll is necessary for photosynthesis:~~

Test if chlorophyll is necessary for p.s.



1. Destarch a plant with variegated leaves by placing it in the dark for two days.
2. Expose the plant to strong sunlight for a few hours.
3. Remove one leaf. Make a drawing to show the distribution of the green parts, i.e. the parts that contain chlorophyll.
4. Decolourise the leaf and test it for starch.
5. Make a drawing of the leaf to show the distribution of the blue-black colour. Compare this with your drawing in step 3.
    a. Before the treatment of the leaf with iodine solution, the leaf must be **de-starched.** This is to ensure that the formation of starch from excess glucose occurred during the experiment.
    b. When iodine solution is applied to the green parts of the leaves, the iodine solution changes from yellowish-brown to blue-black. (Reason: Only those parts containing chlorophyll will absorb light energy and photosynthesis occurs, which produces **excess** glucose, which is converted to starch for storage, so starch is present.)
    c. When iodine solution is applied to the non-green parts of the leaves, the iodine solution remains yellowish-brown. (Reason: Chlorophyll is absent in these parts of the leaves, hence, light energy cannot be absorbed and photosynthesis does not occur, so no glucose is produced. Thus, this does not give rise to excess glucose converted to starch for storage, so starch is absent.)

Experiment 4: Test if carbon dioxide is necessary in photosynthesis:



1. Destarch two potted plants by placing them in the dark for two days.
2. Enclose the pots in polythene bags. Secure the bags to the plant stems.
3. Place one pot in the bell jar. The plant does not have a supply of carbon dioxide from the air because soda lime and potassium hydroxide solution rapidly absorb carbon dioxide. Leave the whole apparatus in strong sunlight for a few hours.

4. Set up a control using pebbles and water in place of soda lime and potassium hydroxide solution respectively. Leave the control apparatus in strong sunlight for a few hours.

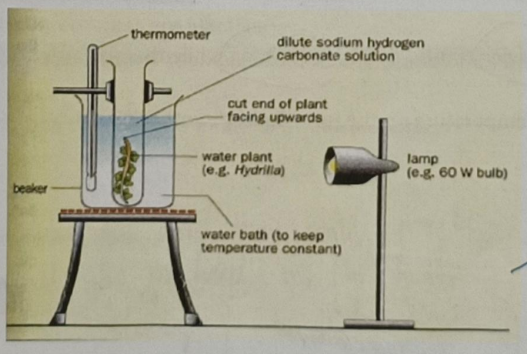
Notes:

a. Chemicals used:
   i. The soda lime serves as a "filter". The soda lime absorbs carbon dioxide from the atmospheric air that enters the bell-jar.
   ii. The sodium hydroxide serves to remove the remaining carbon dioxide in the bell-jar.
   iii. The soda lime and sodium hydroxide hence ensure that there is no carbon dioxide present in the bell-jar.

b. The soil is covered with a polythene bag:
   i. To prevent water loss by evaporation of water in the soil.
   ii. To prevent the contribution of carbon dioxide into the air in the set-up by microorganisms living in the soil that respire.
   iii. When iodine solution is applied to the leaf exposed to air with carbon dioxide, the iodine solution changes from yellowish-brown to blue-black. (Reason: Carbon dioxide is required in photosynthesis. It is reduced by hydrogen to glucose. The excess glucose formed in photosynthesis is converted to starch for storage, so starch is present.)
   iv. When iodine solution is applied to the leaf exposed to air without carbon dioxide, the iodine solution remains yellowish-brown. (Reason: Carbon dioxide is required in photosynthesis. It is reduced by hydrogen to glucose. Without carbon dioxide, no photosynthesis occurs, so no glucose is produced. Thus, this does not give rise to excess glucose converted to starch for storage, so starch is absent.)

b. **Factors affecting the rate of photosynthesis**

Experiment 1: Effect of light intensity on the rate of photosynthesis:



need to add glass to prevent the heat from the lamp affect the rate of p.s

1. Set up the apparatus as shown above with the cut end of the water plant positioned upwards.

2. Air bubbles are given off from the cut end of the plant. Allow some time for the plant to adapt to the conditions provided before taking readings.
3. When the bubbles are produced at a regular rate, count the number of bubbles over a period of 5 minutes. Repeat this a few times to obtain the average rate
4. Repeat step 3 with the light source closer to the plant, e.g. 80 cm, 40 cm, 30 cm, 20 cm, 15 cm and 10 cm. The nearer the light source is to the beaker, the higher the light intensity that the plant is exposed to.
5. Record your results in a table. Plot a graph to show the rate of bubbling per minute against the distance between the lamp and the plant.

- Notes:
  - → Some time is allowed for the rate of bubbling to stabilise. → adapt
  - → Observation: The rate of bubbling increases as the distance of the lamp from the plant decreases.
  - → The dilute sodium hydrogencarbonate solution serves as a source of dissolved carbon dioxide.
  - → In some experiments, sodium bicarbonate is used. Sodium bicarbonate solution spontaneously decomposes to form carbon dioxide.

→ The cut end of the plant faces upwards to allow bubbles containing oxygen to rise.

→ A bubbler may be used in this experiment to serve the following purposes:

1. To ensure that all the bubbles are **of the same size.**
2. Acts as an **electronic counter.**
3. To slow down bubbling to make it **more visible** for the counting of bubbles to be more accurate.

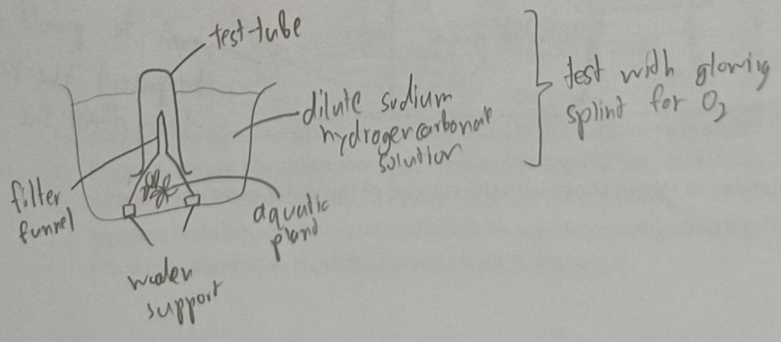
fixing the source of error

→ The bubbles produced contain oxygen gas, **a product of photosynthesis**. Thus, the greater the number of bubbles produced, the higher the rate of photosynthesis. The rate of gas production is **proportional** to the rate of photosynthesis.

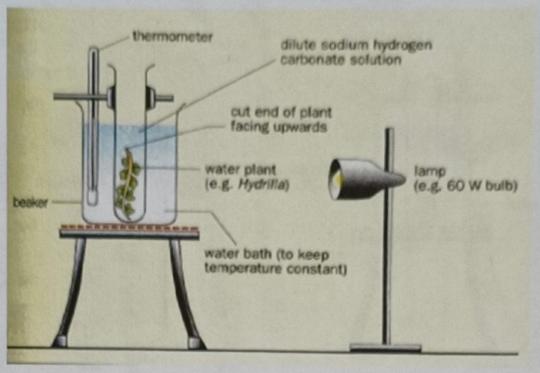
→ The rate of photosynthesis measured by this method may be lower than expected as:

1. Some of the oxygen gas in the bubbles might have dissolved in the water as oxygen gas is slightly soluble in water, hence the number of oxygen bubbles counted may be lower.
2. Some oxygen is used during respiration while the plant is photosynthesising.

~~Experiment 2: Effect of temperature on the rate of photosynthesis:~~



Effect of temp on the rate of P.S



1. Set up the apparatus as shown above with the cut end of the water plant positioned upwards.
2. Place a lamp 10 cm away from the plant. Keep this distance constant throughout the experiment.
3. Add ice-cold water to the water bath to keep the temperature at 5 °C. Allow some time for the plant to adapt to the conditions provided before taking the readings.
4. Count the number of bubbles over a period of 5 minutes. Repeat this a few times to obtain an average rate.
5. Repeat step 4 at different temperatures, e.g. 15°C, 25°C, 35°C, 45°C, 55°C, 65°C and 75°C.
6. Record your results in a table. Plot a graph to show the rate of bubbling per minute against the temperature.

- Notes:

→ The experiment starts off using cold water. This is to check if temperature is a limiting factor. If the water is too warm, the enzymes in the leaf may be denatured.

→ It is observed that the rate of bubbling increases as the temperature is increased. The reactions in photosynthesis are enzyme-dependent.

→ At low temperatures, enzymes are inactive.

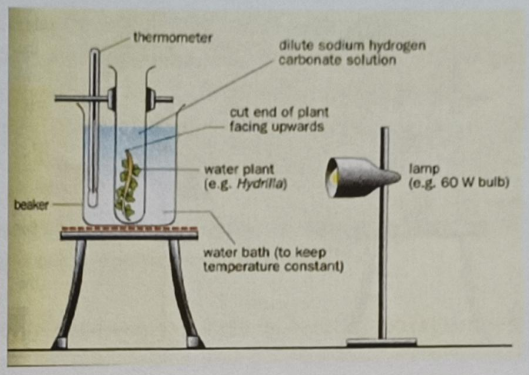
→ At extreme temperatures higher than optimum temperatures, enzymes are denatured.

~~Experiment 3: Effect of carbon dioxide on the rate of photosynthesis:~~

Source of Error:

- Counting bubbles may be an inaccurate way to determine amt. of gas produced as the bubbles may be of diff. size.

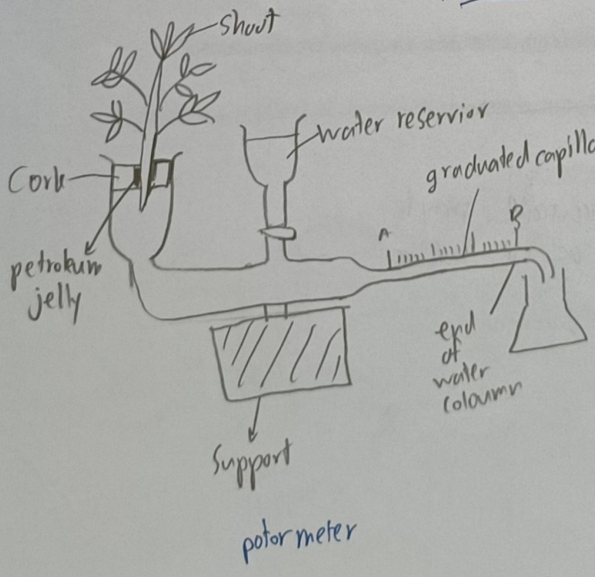
Effect of CO_2 on the rate of P.S



1. Set up the apparatus as shown above with the cut end of the water plant positioned upwards.
2. Place a lamp 10 cm away from the plant. Keep this distance constant throughout the experiment.
3. Conduct the experiment at room temperature.
4. Use different concentrations of sodium hydrogencarbonate solutions, e.g. 0.01 mol/dm^3, 0.02 mol/dm^3, 0.03 mol/dm^3, 0.04 mol/dm^3, 0.05 mol/dm^3, up to 0.1 mol/dm^3. (These are proportional to the carbon dioxide concentrations in the solution.)
5. When the bubbles are coming out at a regular rate, measure the rate of bubbling for each concentration of the sodium hydrogencarbonate solution.
6. Plot a graph to show the rate of bubbling against the concentration of the solution.

- Notes:
  - → Different concentrations of sodium hydrogencarbonate solutions are used.
  - → It is observed that the rate of bubbling increases as the concentration of the sodium hydrogencarbonate solution is increased.

Find rate of transpiration



rate of transpiration = $\frac{\text{volume of water}}{\text{time taken}}$

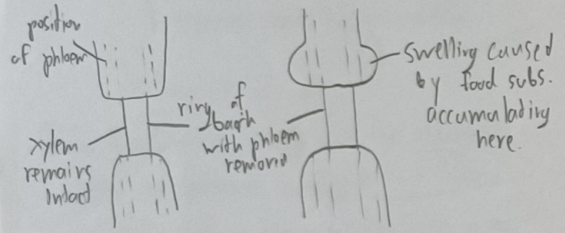
Take note:
- Not all water are taken up by the plant is used for transpiration
  - ↳ used for P.S.
  - ↳ used for maintaining turgidity of the cells.

Translocation

↳ the transport of manufactured food subst., such as sugars & A.a., in plant

Evidence:

- Using the 'Ringing' Experiment



- Using ~~Apids~~ Aphids in Translocation studies

1. ~~Anaesthetise~~ the aphid with CO_2 while its feeding on the stem.
2. Cut off the ~~aphid~~ body of the aphid, leaving the feeding stylet in the plant tissue
3. Analysis the liquid that exude from the cut end of the stylet
   ↳ It should ~~be~~ contain sucrose & A.a.
4. Section the portion of the stem that contain the stylet.
5. examine it under microscope.
   ↳ the stylet is inserted into the phloem sieve tube
   ↳ shows that translocation of sugars & A.a. occurs in phloem

- Using Isotopes in Translocation Studies

1. Supply carbon dioxide containing the radioactive carbon, ^{14}C
2. Allow p.s. to take place, the sugar formed will contain radioactive carbon
3. Cut a section of the ~~stem~~ and expose it onto an X-ray photographic film.
4. It is found that radioactive subst. are present in the phloem, since radioactive subst. cause the X-ray film to darken

movement of water → ~~static~~ structure of Root hair cell → thin film of liquid around

movement of mineral salt

① water enter root hair cell via osmosis thru. C.M. as the cell sap has a lower w.p. than the soil solution.

② The entry of water dilutes the cell sap.

③ The cell sap of the root hair cell now has a higher w.p. than that of the next cell. Hence, water passes by osmosis from the root hair cell into the inner cell.

④ Similarly, water passes from cell B into the next cell.

⑤ This process continues until the water enters the xylem vessels & moves up the plant.

R.H.C is ① active transport dilute mineral salt

Transpiration
↳ the loss of water vapour from the aerial parts of a plant, mainly through the stomata.

→ Transpiration pull
↳ the suction force created due to transpiration that pulls water & mineral salts up the xylem

↳ how it occur:

① In leaves, water moves out the mesophyll cells by osmosis, forming a thin film of moisture, which evaporates into water vapour in the intercellular air spaces

② It diffuses out of leaves via ~~diff~~ stomata, down its concentration gradient.

③ As water evaporates from the thin film of moisture, more water moves out from mesophyll cells to replenish it.

④ As water lost from the mesophyll cells, the w.p. of their cell sap ↓ & become lower than that of their neighbouring mesophyll cells

⑤ The cells deeper inside the leaf then draw water from the xylem by osmosis. This creates a suction force which pulls the whole column of water up the xylem vessels. This force is known as transpiration pull.

→ Factors affecting Rate of Transpiration:

- Wind/Air movement
  ↳ the stronger the wind, the ↑ rate of Trans.
  ↳ conc. of gradient of water
  ↳ to investigate:
  - compare in a room with the ceiling fan switched on and switch off(still air)

- Temperature of the air → ↑ KE
  ↳ the higher the temp, the ↑ rate of Trans.
  ↳ ↑ temp, ↑ rate of evaporation of H_2O from the cell surface
  ↳ To investigate:
  - compare in a room with air conditioner switched on/off

- Light → ↑ P.S. → ↑ water moves up & out
  ↳ size of the stomata
  ↳ to investigate:
  - compare in a dark room with table lamp at various dist.

- Humidity of the Air
  ↳ the humidity ↑, the ↓ rate of trans.
  ↳ conc. gradient of water

→ wilting
↳ occur when rate of trans. > rate of water uptake
↳ Due to a net loss of water to the plant, central vacuoles of cells shrink, plasmolysed mesophyll cells lose turgor pressure & become flaccid, resulting in the wilted look of the plant
↳ cause:
- too ↑ light intensity
- too ↑ temp.
- Too much fertiliser, lowering soil w.p. below that of root cells, resulting in water leaving the roots

↳ Adv:
- ↓ leaf SA + flaccid guard cells close stomata ↓ trans. rate, which help conserve water

↳ Disadv:
- Due to closed stomata, less CO_2 enters leaves.
- Due to reduced leaf SA, less light is captured, leading to reduced PS. rate.

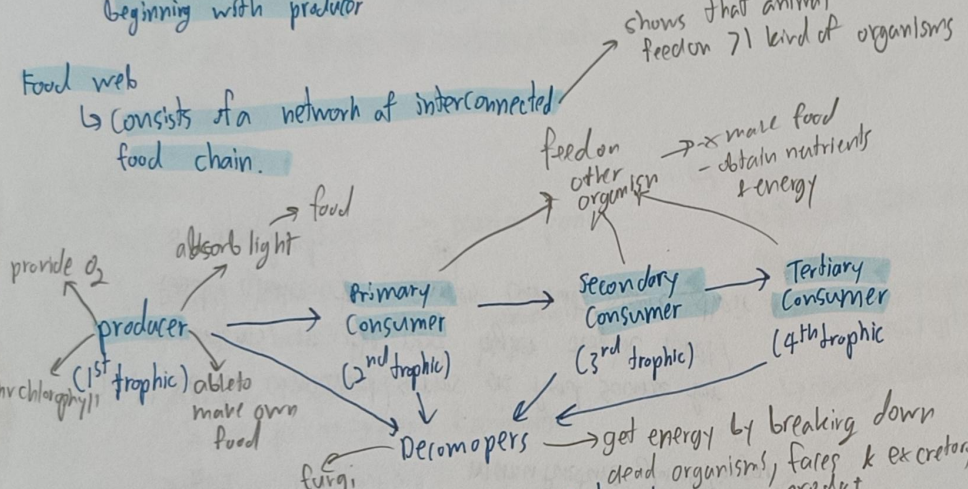
Describe & explain how changes in surrounding temp. can affect the change in mass of the leaves.

- Warmer environment ↑ transpiration
- moisture lining on mesophyll surface evaporate faster
- increased conc. of accumulated water vapour in intercellular airspaces.
- Higher conc. of water vapour molecules inside the leaf than outside atmosphere
- water vapour diffuses out + faster + thru. stomata.

Chpt 13

Food chain
↳ shows energy transfer thru. a series of organisms, beginning with producer

Food web
↳ consists of a network of interconnected food chain.



land: grass → rabbit → snake → hawk
aquatic: water plants → tadpole → pond skater → frog

→ Energy (non-cyclical)
↳ 10% of energy passed on only
↳ lost as:
- heat during respiration
- Uneaten parts of the prey
- faces
- excretory products

↳ only 1% of solar energy that reaches the earth is trapped by plants/producers

parasite
↳ feed on host.
↳ reproduce on host
∴ > no. than host

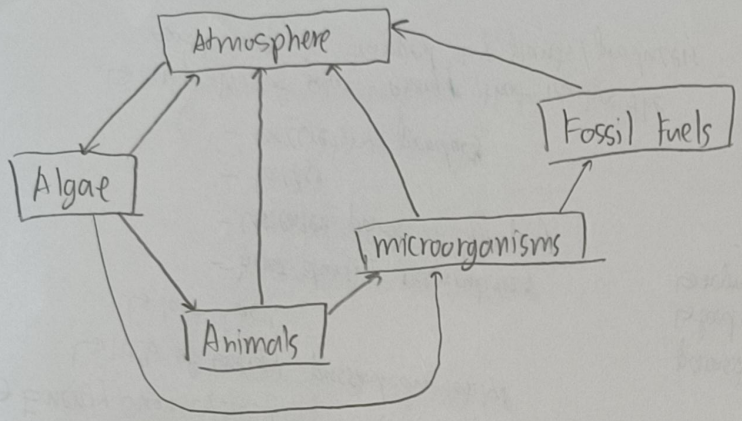
→ Carbon Cycle
↳ C is taken in when:
- Plants P.S.
- formation of fossil fuel under ↑ pressure & temp.

↳ C is released when:
- Respiration
- Decomposition → speed up when temp. is higher & humid
- Combustion

↳ Importance:
- Continuous supply of CO_2 for P.S.
↳ enable flow of energy
- regulate the amt. of CO_2 in atmosphere.

→ Pyramids of Numbers → counting no. of organisms of each species, at a particular time in the same area at each trophic lvl
↳ limitations:
- X consider thesize & mass of organisms
- X consider whether the organism is an adult/juvenile

→ Pyramids of Biomass → removed water → dry mass → compare total mass of living organisms in each trophic lvl
↳ higher accuracy → consider size & mass
↳ limitations:
- organisms have to be killed obtain biomass
- has to be constructed at a particular point in time.



State the roles played by algae in this carbon cycle.

1. Algae is the producer + uses sunlight for p.s. / manufacture glucose/sugar

2. Algae is consumed / serves as food source for organisms in the next higher trophic level / food chain + consumers cannot make their own food.

arbon Sinks

↳ An area that stores carbon from the atmosphere for a long period of time. It stores > carbon than it release

↳ Ocean

↳ CO_2 dissolves + p.s. → marine plants

↳ Fossil fuels at seabed

↳ dead bodies of plants & animals

↳ Aerobic respiration

↳ description ⇒ plants & animals

↳ Feeding relationship

↳ carbon compounds in plants gets eaten by marine animals. Carbon is transferred to the consumers. Carbon cannot escape the ocean as it is now in the consumer

> process take in CO_2 than release CO_2 ☺

↳ CO_2 used by marine animals to form shells & corals

↳ retain C for a long period of time after they died.

↳ Forest

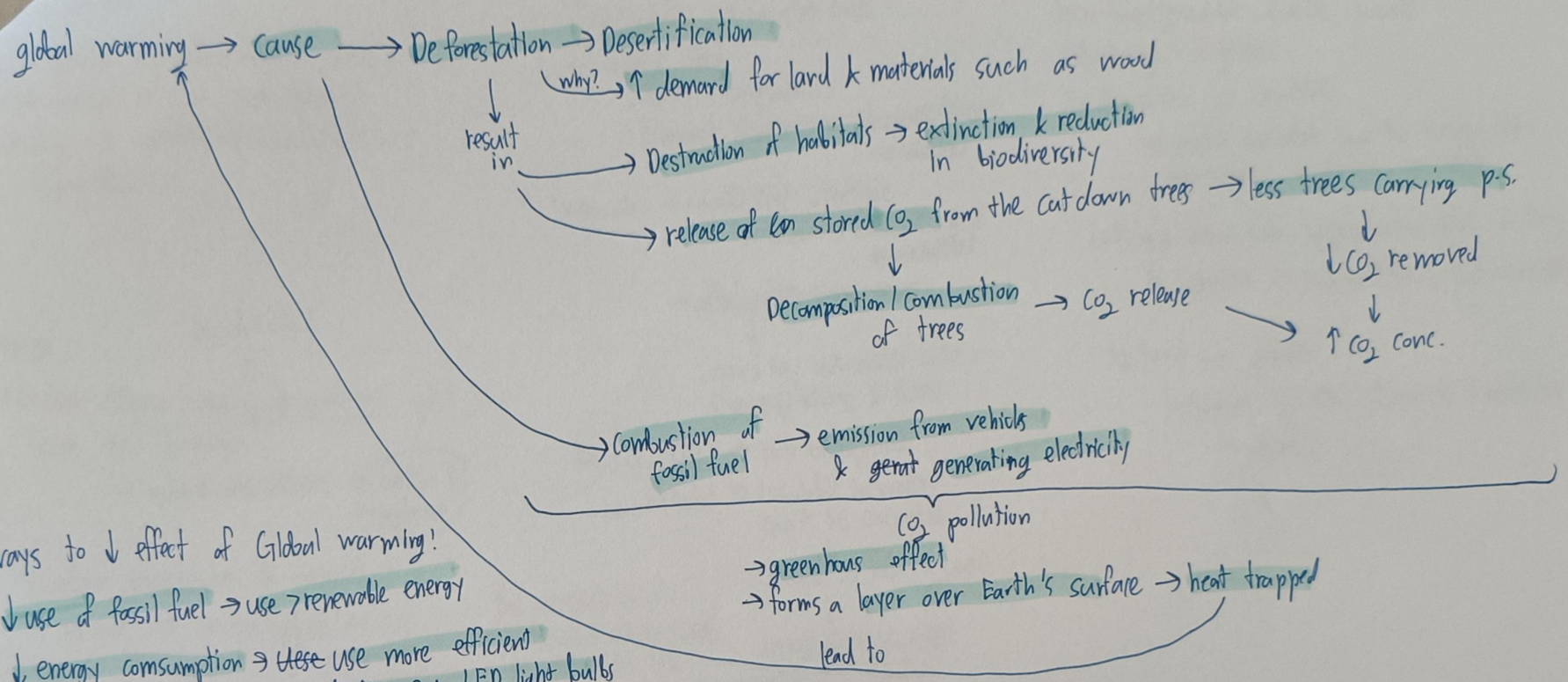
↳ P.S. + store of C compound → Trees

↳ formation of coal → Trees die

↳ an Aerobic respiration

↳ description

↳ Feeding relationship



Ways to ↓ effect of Global warming!

- ↓ use of fossil fuel → use ↑ renewable energy
- ↓ energy comsumption → ~~Use~~ use more efficient devices e.g. LED light bulbs

→ Use hybrid/electric vehicles rather than petrol-powered vehicle

→ Forest management → Conservation of forest

→ Indiscrimate felling of trees shld be reduced

→ Reforestation

→ Control of forest fires → Some ppl set fire to clear forests

→ Education

~~ion is th~~

↳ The process by which harmful subst. are added to the environment, making it undesirable or unfit for life

Insecticides → harmful subst.

↳ kill insects that:
- destroy crop plant
- transmit diseases. e.g. dengue fever & malaria

↳ Disadv. → ineffective overtime
↳ resistant → favourable gene transmitted

→ affect other organisms

↓

Carried by rainwater into streams, rivers & lakes

↳ E.g. DDT → non-biodegrable
(DDT: harmful subst.)
↳ insoluble in water, can't be excreted

↓

stored in fatty tissue

↓

accumulate in the consumer's body

↓

bioaccumulation

↓

Biomagnifications/bioamplification

→ one predator feed on many prey

the accumulation of chemical subst. such as pesticides in an organism

occurs when certain chemicals e.g. insecticides, are passed along the food chain, ↑ in conc. in the bodies of organisms along the trophic lvl.

↑ DDT ← top consumer

suffer toxic effects

unfit

Sewage

↳ Contain disease-causing organisms (harmful subst.) such as bateria

↳ water-borne disease → Cholera & typhoid (unfit)

↳ Contain phosphates & nitrates

↳ lead to ~~en~~ Eutrophication

↓ cause by

Inorganic chemical fertilisers ← harmful subst.

↳ Excessive growth of water plant & algae

↓

promote bacterin growth

↓

✕ submerged plant

↓

decomposition

↓

✕ on O_2 → undesirable

Non-biodegradable plastic waste

↳ burning of plastic

↳ deposition in landfills

↳ harmful chemicals may be leached into rivers/seas → poison wildlife

↳ break down into microplastic that is tiny

↳ Ingested → accumulation → biomagnification

↳ Feed on plastic

↳ block up the stomach & intestine

↳ death

…sity
↳ the range of species that are present in a particular system

nservation
↳ protection & preservation of natural resources in the environ.

↳ Reason!
- Wild plants & animals posses favourable gene → cross-breeding → ↑ agriculture prod.
- Sources of medical drugs → trophical plant
- Prevent extinction of a species
  ↓
  genetic diversity maintained
  ↓
  less likely any change in environ. will wipe out the whole species
- Marine Plant → food
- tropical plants → raw material for industries → rubber → tyres
- Scientific research
- Maintain stable & balanced ecosystem
- Preserve natural scenergy & wildlife for people to appriciate

- Conservation of Mangrove swamp
↳ Mangrove Restoration Project
↳ Volunteers plant mangrove seedling over a portion of the Mangrove swamp
↳ 'Adopt a Mangrove Programme'
↳ initiated in Sg at Pulau ubin
↳ raise awarness about conservation & restoration of degraded areas to ↓ the Impact of global warming & Climate change

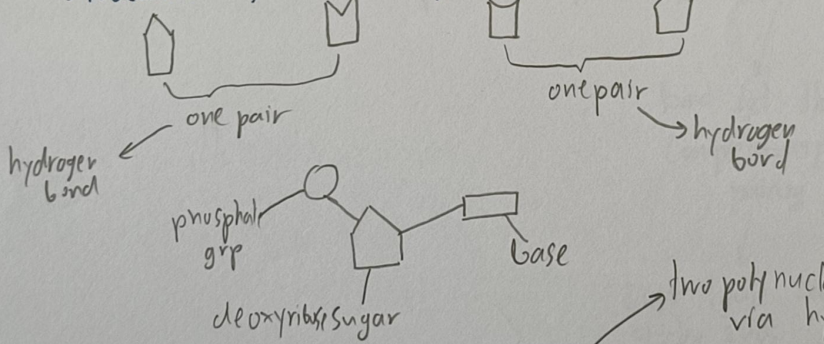
- Conservation of Coral Reefs
↳ x touch the reefs
↳ may damage the coral animals
↳ x anchor boats on the reef
↳ may kill the corals
↳ Avoid! - purchase living corals → promote extraction of living corals for sale
- the use of sunscreen
↳ ingredient can be harmful to corals
- polluting the coast w rubbish, espicially non-biodegradeable plastic
↳ marine debris may be blown or washed into the ocean
↳ harmful to coral reefs

Dai Jia Cheng
E8
Chpt 14

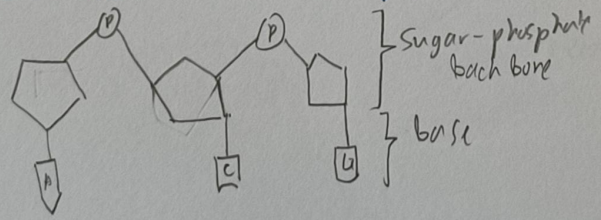
→ Deoxyribonucleic acid
↳ carry genetic information → development & functioning
↳ consists of two strands of nucleotides twisted around each other to form a double helix

↳ Basic unit : Nucleotide
↳ made up of :
- Deoxyribose sugar
- Phosphate group
- Nitrogen base
↳ Adenine (A), thymine (T), Cytosine (C), Guanine (G)

uracil becomes U in mRNA



↳ long chain chain of Nucleotide : polynucleotide → two polynucleotide connected via hydrogen bonds



→ Gene
↳ a sequence of DNA nucleotides, as part of a DNA molecules, that code for a specific polypeptide
↳ a unit of inheritance

→ Chromosome
↳ A DNA molecule wrap around special proteins → histone

histone

Three base make up 1 ~~codon~~ codon

formation of polypetides:

1. The DNA uncoil, opening the polynucleotides
2. In the nucleus, the msg in the gene is copied into an mRNA
3. The mRNA travels out of the nucleus via the nucleus pores then to the cytoplasm & attaches to a ribosome
4. As the ribosome move along the mRNA, it synthesises a polypeptide
5. When the ribosome leaves the mRNA, the polypeptide is released.

Transcription
↳ in nucleus
↳ step 1-2

Translation
↳ in cytoplasm
↳ step 3-5

→ A vector is required for the transfer of genes
↳ another DNA molecule, a bacteria/virus that is used to carry the genes of one organism into another
↳ E.g. plasmid (circular DNA)
↳ from bacteria

→ Transgenic organisms
↳ an organisms that has a foreign gene inserted into its genome or DNA

→ when same restriction enzyme is ~~dd~~ added to the vector & the DNA containing the gene of interest
↳ produce complementary sticky ends

↓

bind tgt thru. Complementary base pairing

↓

DNA ligase seals the sticky ends

↓

recombinant DNA formed

ducing Transgenic Bateria to Manufacture insulin → ethical concerns overcomed
↳ vegetarians will object the use of insulin obtained from animals

Step 1: - Remove DNA containing human insulin gene from nucleus of cells
- Cut out insulin gene with restriction enzyme, sticky end produced on both sides of the gene

Step 2: - Isolate plasmid from E.coil bacterin
- Cut open plasmid with the same restriction enzyme

Step 3: - Mix insuline gene with the cut plasmid & allow the ske sticky ends to base-pair
- Add DNA ligase to join insuline gene & plasmid, recombinant plasmid is formed

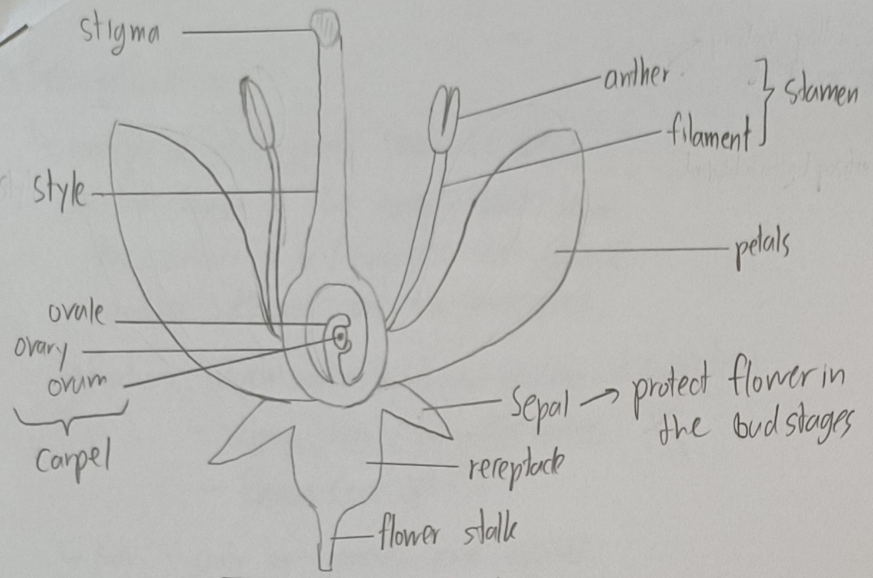
Step 4: - Mix recombinant plasmid & E.coil
- Apply temporary heat/electric shock to open up the pores of c.m. of E.coil for it to enter, transgenic bacterium produced

Step 5: - The transgenic bacterium produces human insulin.
- Insulin is extracted & purified to use
- isolated & grown in a fermeter for mass production of human insulin

~~Social implications~~

Benefits
- Low-cost production of medicine → affordable (economic)
- treat genetic diseases → saves lives (medicine)
- Crops
  - ↳ grow in extreme condition → ↑ crop yields → ↓ food shortage (economic)
  - ↳ higher nutritional value → ↓ malnutrition
  - ↳ ~~grow~~ produce own pesticide → less pesticides needed spray → environmental friendly

Ethical considerations
- Potential use for biological warfare → mass destruction (social impact)
- Monopoly of the sale of GM-seeds (economic)
- Allerigies to some ppl ~~dur~~ due to new protein in GM food
- Companies may set patents on medicines made using genetic engineering → very ex → no choice but have to pay at high price (social)



Insect-pollinated plants

→ petals → Large, brightly coloured → attract insects
↳ platform, guidance
→ Scent
↳ fragrant/sweet-smelling

→ Stamen → × pendulous
→ × protrude out of flower

→ Stigma → small
→ × protrude out

→ pollen → less abundant
→ larger, heavier & rough

→ Nectar → present

→ Nectar guide → present on the petals

Stamen

→ anther → produce pollen grain
→ mature → splits → ~~release~~ release

→ Filament → hold position

→ pollen grains (PG)
↳ contain male gametes → produced by meisosis & r haploid
↳ Hv half the no. of chromosoma

Carpel

→ Stigma (MS) → Receives pollen grains
→ Secretes sugary fluid to stimulate germination of PG when mature

→ Style → Holds the stigma in position to trap PG

→ Ovary → Contain ≥ 1 ovules
↳ Contain ovum (female gametes)
↳ egg

Wind-pollinated plants

→ petals → small, dull-coloured / absent

→ stamen → pendulous
→ anther protrude out

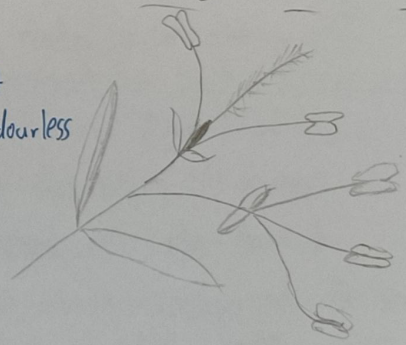
→ Stigma → Large & feathery

→ pollen grains → more abundant
→ smaller, lighter & smooth

→ Nectar → absent

→ Nectar guide → absent

→ Scent
↳ odourless



→ Self pollination

↳ transfer of pollen grains from the anther to the stigma of the same flower / from the anther of a flower to the stigma of another flower on the same plant

↳ Featurs : - Both anthers & stigma mature at same time
- stigma directly below the anthers
- flowers nvr open

↳ Adv: - only one parent plant required
- ✗ depend on external factors for pollination
- less ~~em~~ pollen & energy are wasted
- Beneficial qualities are more likely to pass down
- ↑ chance of pollination to occur

↳ disadv: - less genetic variation
↳ less adapted to environ. changes
- offspring become weaker, smaller & less resistant to diseases

→ Cross pollination

↳ transfer of pollen grains from the anther of a flower do the stigma of a flower of another plant belonging to the same species

↳ Features : - only male / female flowers
- anthers & stigma mature at diff. time
- anthers & stigmas located very far away

↳ Adv: - greater genetic variation
- may inherit beneficial qualities from both parents
- Seeds produced are more viable & capable of surviving longer before germination

↳ ~~Dis~~Disadv: - opp. of the adv. of cross-pollination.

→ Fertilisation

① PG germinate in response to the sugary fluid secreted by MS

② pollen tube grows out of each pollen grain &

③ Secretes enzymes that digest the stigma, style & ovary wall

④ The pollen tube enters the ovule through micropyle

⑤ Within the ovule, the tip of pollen tube absorbs sap & bursts, releasing male gamete

⑥ The nucleus of the male gamete fuses with the nucleus of the ovum to form zygote (fertilisation)

⑦ After fertilisation, the ovary develops into the fruit & the ovule develops into the seeds

Sepals & petals ~~wither~~ ~~wither~~ wither & drop off

chpt 18 DJC

→ Inheritance
↳ transmission of traits from one generation to another

→ Gene
↳ a sequence of DNA ~~molecules~~ nucleotides that controls the formation of a single polypeptide.
↳ A unit of inheritance

→ Alleles
↳ diff. forms of the same gene
↳ occupy the same relative position on a pair of homologous chromosomes.

→ genotypes
↳ combination of alleles for a particular gene

→ phenotypes
↳ expressed trait or outward appearance

→ Homozygous
↳ having two identical alleles of a particular gene

→ Heterozygous
↳ having two different alleles of a particular gene

→ Genetic Diagram *** e.g blood grp

	(Man)		(Wife)
parental phenotype	Blood grp A	×	Blood grp B
parental genotype	$I^A I^O$	×	$I^B I^O$
Gametes	I^A I^O		I^B I^O
offspring genotype	$I^A I^B$	$I^A I^O$	$I^B I^O$ $I^O I^O$
offspring phenotype	AB	A	B O
phenotype ratio	AB : A : B : O = 1 : 1 : 1 : 1		

very impt

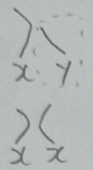
If involved xy chromosomes, rmb to indicate the sex.

→ Co-dominance
↳ both alleles express themselves in the heterozygote, which has a phenotype intermediate bet. that of pure-bred parents
↳ E.g. Blood group AB $I^A I^B$
↳ I^A & I^B are codominant

→ Multiple alleles
↳ presence of ~~two or~~ more than 2 alleles option for a single gene
↳ A gene that exists in > 2 diff. forms have ~~must~~ multiple alleles
↳ e.g. Blood grp → three alleles
→ 6 different forms
→ 4 expressed trait

→ Why observed ratio differ from expected ratios
↳ Sample size too small
↳ Inheritance of particular combinations of alleles occurs by chances & probability
↳ Inheritance of alleles for each offspring is independence of one another.

→ Determination of sex in human
↳ Look at the 23 pair
↳ Male → XY
↳ Female → XX



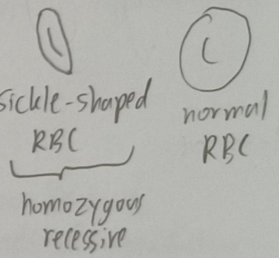
→ No. of chromosomes in body cells
↳ Male → 44 non-sex chromosomes + X + Y
↳ Female → 22 NSC + X + X

→ No. of Chromosomes in Gametes
↳ Male → 22 NSC + X / Y
↳ Female → 22 NSC + X only

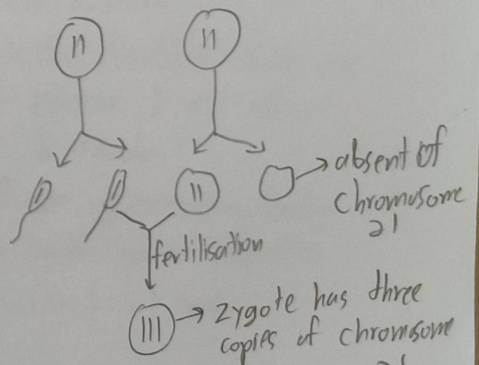
→ Genetic variation
↳ Meiosis → human
↳ Random fertilisation → any of the sperm can fuse with the ovule
↳ Mutation
↳ rate of mutation can increase by:
- radiation e.g. X-ray, UV, α, β, γ
- Chemical mutagens
↳ Tar & formaldehyde (cigarette)

→ Mutation
↳ change in the sequence of a gene or in the ~~number~~ chromosome number

↳ Gene mutation
↳ Albinism (白化病)
↳ absence of pigment in the skin, hair & eyes
reddish-white
iris red
↳ Sickle Cell Anaemia → the ~~recessive~~ homozygous recessive
↳ change in the sequence of bases/nucleotide in DNA
↳ Encodes haemoglobin S (HbS) protein in RBC (abnormal
↳ change in the 3-D shape of the hae. molecule.
↳ O_2 conc. ↓, the RBC becomes sickle-shaped
↳ ✗ transport O_2
↳ ~~frg~~ fragile & sticky → stuck in narrow blood vessels } fatal



↳ Chromosome mutation
↳ Down Syndrome : 47 chromosomes
↳ Normal human : 46 chromosomes
↳ there is one more extra copy of chromosomes 21
↳ Higher chance when mother is older, similarly in man



→ Variation

↳ Differences in traits bet. individuals of the same species

↳ Discontinuous v.s. Continuous

Discontinuous	Continuous
Controlled by one or few gene	Controlled by many genes
Gene do not show additive effect	Genes show addictive effect
Unaffected by environ. condition	Greatly affected by environ. condition
Clear-cut phenotypes	A range of intermediate phenotype
- Gender/sex - Blood grp - Eye Colour	- Height - weight - Skin colour

→ Natural selection

↳ process in which organisms with desirable genes & characteristic are 'selected'/'favoured' to survive & pass on their genes to their offspring

→ Evolution

↳ gradual change in the inheritable characteristics of a population over time

→ Evolution with natural selection

↳ Variation & competition lead to:

- cross-breeding
- Spontaneous mutation of genes

- Diff. of survival of
- Reproduction by

} those organisms best fitted to the environ.

↳ Environmental factors

↳ Predation: Dark peppered Moths → Camouflage btr

↳ Food shortage: Darwin's Finches ⇒ finches develop different ~~peaks~~ beaks to be suited to a particular diet on the island to reproduce & survive

↳ Diseases: Antibiotic-resistant strains of bacteria

↳ ↳ Template: 1. * The variation *

↳ e.g. behind

2. Individuals with (so-&-so) traits are more likely to survive longer, resulting in a higher rate of reproduction
3. & are more likely to pass on the genes for that trait to their offspring,
4. resulting in increased genetic variation
5. The offspring that inherit the beneficial traits are able to adapt to the environ. & will ~~allow~~ more likely to survive & reproduce
6. This process repeats itself over generation, leading to a population with a higher ~~porpo~~ proportion of individuals with (so-&-so) trait.

E.g. -Spontaneous mutation of genes from common ancestor w wld hv produced birds with various beak length
- Competition for food wld hv resulted in survival of the fittest
- The birds with the longest beaks wld hv ~~alr~~ been naturally selected since they are able to get food more easily
- These birds reproduce & pass on their favourable allele to offspring while other birds with shorter beaks ~~out~~ are outcompeted & die out
- This results in long beaked birds becoming the dominant species on the island over time.