Standard Grade Biology Study Notes

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Biosphere subtopic a - Investigating an ecosystem

General

G1. What is an ecosystem made up of?
Habitats, plants and animals.

G2. How would you sample the number of plants or animals in an area?
Plants - use a quadrat and animals - use a pitfall trap or nets.

G4. Name two abiotic factors.
Light, moisture or pH.

G4. Give an example of a technique used to measure an abiotic factor and describe its use.
A light meter will measure light levels. A moisture meter will measure moisture levels and a pH meter will measure pH levels in the soil.

G6. How does an abiotic factor affect the distribution of organisms.
The abiotic factor may determine where the organism lives.

Credit

C2. How would you minimise the errors with the technique to count plants in an area?
Increase the number of quadrats used, use a key to identify plants, throw it randomly and count the squares (not the plants).

C2. How would you minimise the errors with this technique to count animals in an area?
Increase the number of pitfall traps used, use a lid, put holes in the bottom and check regularly.

C4. Identify a possible source of error with measuring your abiotic factor and explain how it might be minimised.
Light meter - you may shadow over the meter and change the light levels. A cloud may cover the sun and change the light levels. The reading should be taken at the same time of day.
Moisture meter - ensure the meter in fully in the soil. Ensure the probe is wiped after each reading.
pH meter - ensure the probe is wiped each time after a reading is made.

C6. How can abiotic factors influence where an organism lives?
Plants need light & water and many will only grow if there is a lot of light & water. Some plants need a specific pH to grow. Some animals will live where it is dark & will move away from the light so they are hidden from predators. They need moisture so they do not dry out e.g woodlice.

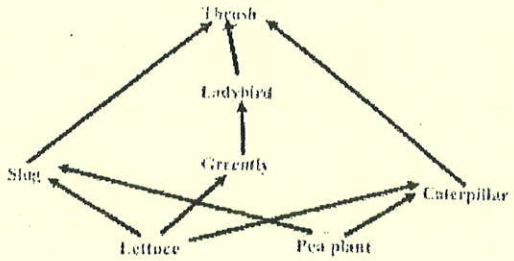
Biosphere subtopic b - How it works

General

G7. What is meant by habitat, population, community and ecosystem?
Habitat - a place where an organism lives.
Population - total number of one type of organism.
Community - total number of all organisms living in an area.
Ecosystem - all the organisms and the habitat in an area.

G8. What is meant by consumer and producer?
Consumer - gets energy from eating other organisms.
Producer - plants which make their own food.

G9. Give an example of a food web and food chain.
grass ⟶ rabbit ⟶ fox



G10. What do arrows in a food web show?
Energy flow.

G10. Name two ways in which energy can be lost in a food chain.
Movement, heat and undigested waste.

G11. The growth rate of a population depends on the birth and death rate. What is meant by the birth rate and death rate of a population?
Birth rate is the number of births per year.
Death rate is the number of deaths per year.
If the birth rate is greater than the death rate a population will increase.
If the birth rate is less than the death rate than the population will decrease.
If the birth rate equals the death rate the population will remain stable.

G12. Name three factors which could limit a population.
Disease, lack of food, lack of nutrients, lack of water, lack of space or predators.

G13. What is competition?
When animals or plants compete for the same resources e.g food, space or light.

G13. Describe some effects of competition.
One population may decrease in number if competition is great. The stronger species survives and the weaker species dies.

G14. Why are nutrient cycles such as carbon and nitrogen important?
They cannot be wasted as they are limited & found in plants & animals.

Credit

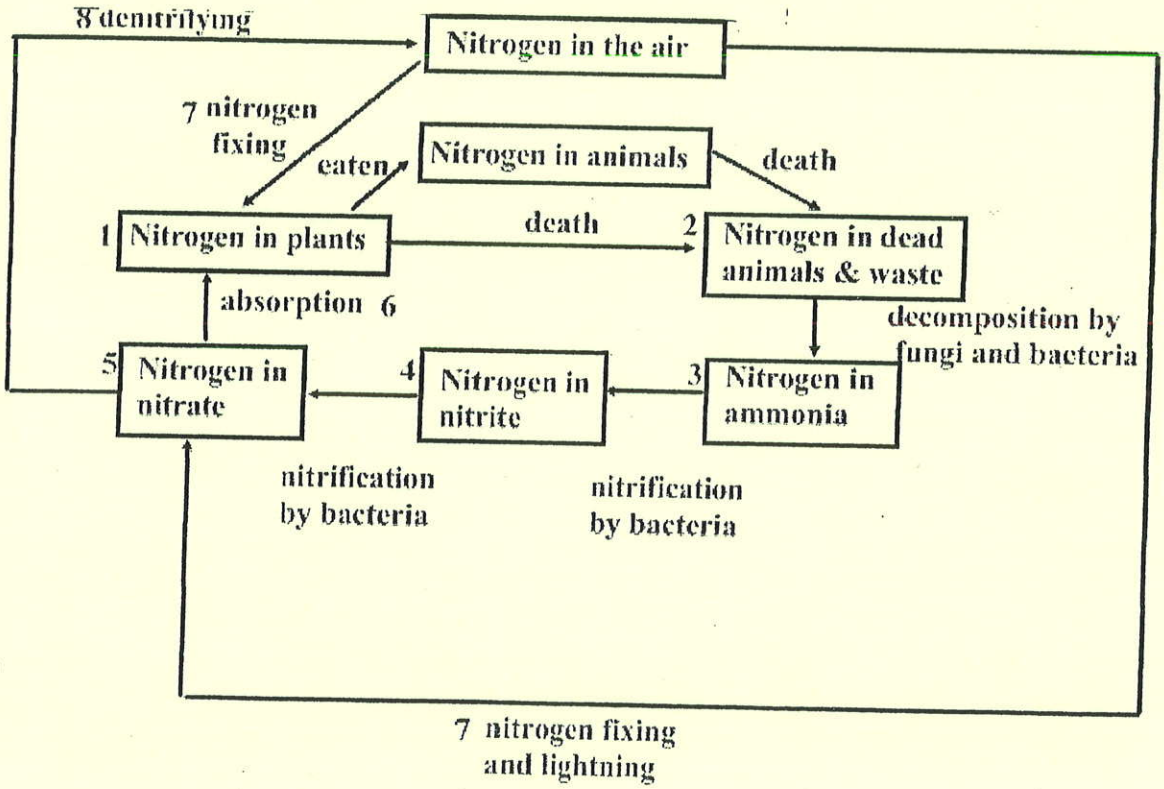
C9. Explain the effects of removing one animal or plant from the food chain.
An organism may decrease in numbers if it has not enough food. Another organism may increase in numbers if it is not eaten.

C10. What is meant by a pyramid of numbers?
This is a diagram showing the numbers of organisms at each stage in a food chain.

C11. What is meant by a pyramid of biomass?
This is a diagram showing the mass of each organism at each stage in a food chain. It also shows the energy loss at each stage in a food chain.

C12. Describe a growth curve of a population under ideal conditions.
The population will continue to increase until a factor is in short supply.

C14. Describe in detail the nitrogen cycle.



Extra questions

C14. What is decomposition?
This is when bacteria decompose dead bodies and wastes and convert them into compounds containing ammonia.

C14. What is nitrification?
This is when bacteria convert ammonium compounds into nitrites and other bacteria change nitrites into nitrates.

C14. What is nitrogen fixation?
This is when bacteria in the soil absorb nitrogen from the air and fix it into nitrates for the plants to use for growing.

C14. What is denitrification?
This is when bacteria in the soil remove nitrates in the ground to release nitrogen gas.

C14. Why do some plants have root nodules?
These contain nitrogen fixing bacteria which fix nitrogen from the air into nitrates for the plants to use for growth.

C14. Name three plants which have root nodules.
Clover, pea and bean.

C14. Why is nitrogen important?
It is used to make protein in plants and animals.

Biosphere subtopic c - Control and Management

General

G15. What are the three areas that pollution affects?
Air, sea and land.

G15. Where are the main sources of pollution from?
Industry, agriculture and domestic sources.

G15. Give an example of a source of pollution from each of the above examples.
Industry - sulphur dioxide gas *d into rivers.*
Agriculture - excess fertiliser that runs off fields into rivers.
Domestic - household rubbish, sewage.

G16. Give one way in which the pollution may be controlled.
Treat waste before it is dumped into rivers.
Reduce the amount of fertiliser used on fields.
Recycle your rubbish.

G17. What is the food source for bacteria in a polluted river.
Sewage *(organic waste).*

G17. What happens to the concentration of oxygen in a polluted river?
Decreases - bacteria use it for respiration

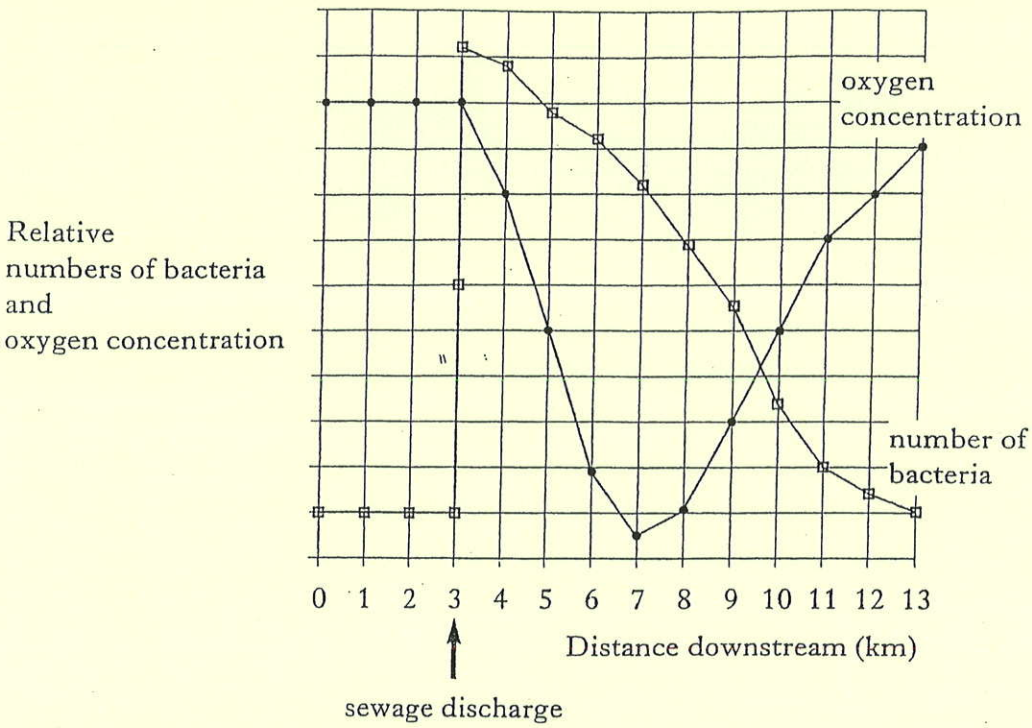
G18. Give examples of poor management of natural resources & any improvements.
Cutting down the rain forests - try to stop this.
Overuse of fertilisers in fields which pollute waterways - use less fertiliser.

G18. Describe how the effects of poor management of natural resources can produce problems.
Cutting down rain forests - animals lose their homes and species are wipe out. Plants take in carbon dioxide and if we cut down trees the gas balance is affected.
Fertilisers - rivers are polluted and organisms die.

Credit

C15. Explain an adverse effect of using fossil fuels and nuclear power as energy sources.
Fossil fuels pollute the air with sulphur dioxide and other gases. These contribute to the greenhouse effect, causing the earth to increase in temperature. This can cause widespread flooding.
Nuclear power is dangerous because if there is an accident harmful radiation will leak which can cause cancer and leukemia.

C17. What is the relationship between level of pollution with organic waste, numbers of micro-organisms, oxygen concentration and number of species?
If waste levels are high, the number of micro-organisms are high. This is because they have a food source and will grow and multiply.
Oxygen levels will decrease because the micro-organisms like bacteria will use up the oxygen for respiration.
The number of species is low because only a few organisms can live in very low levels of oxygen.



C17. What is meant by an indicator species?
This organism's presence or absence indicates how polluted an area is.

C18. <u>Explain</u> how parts of an ecosystem are controlled in either agriculture or forestry.
Fields are watered and fertilised to produce food and for animals to graze on.
Forests are maintained and new trees planted in forests for wood.

The World of Plants Subtopic a - Introducing plants

General

G1. Give two advantages of there being a wide variety of plants.
A good selection of food, habitats and resources e.g. medicine, building materials.

G2. Describe three specialised uses of plants.
Food - apple, wheat, lettuce etc,
Building materials - wood,
Clothing - cotton,
Ornamental - any flowering plants,
Perfumes - roses etc,
Medicines - poppy and foxglove.

Credit

C1. Explain possible consequences to man and other animals of a reduction in plant species.
Habitats are lost - animals and humans lose their homes.
Medicine - if plants are lost some medicines can't be made.
Food - some foods are lost.

C2. Describe a production or refining process such as malting barley and timber.
Timber production -
1. The land is prepared by digging trenches to get rid of extra water and allow air into the soil.
2. Young trees are brought from the nursery and planted in rows.
3. As the years go by poorer trees are removed by thinning to allow the better ones to grow. Fertilisers are added by helicopter to ensure good growth.
4. The lower branches are trimmed after 10 years and after 50 years the mature trees are cut down using chain saws.

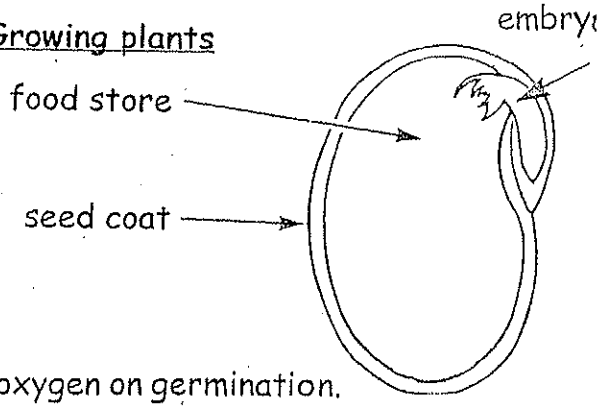
Malting barley -
1. Barley grains are spread out in moist warm conditions on the floor so they germinate.
2. The large starch molecule inside the grain is converted into a small sugar molecule. This is called malting. The malt formed is rich in sugar and is the food needed by yeast during fermentation. The yeast turn the sugar into alcohol and *carbon dioxide.*

C2. Describe two potential uses of plants.
Medicine - new plants could have cures for cancer.
Food - some foods may be grown where it is very hot and there is little water.

General

G3. Describe the function of the parts of a seed.

Seed coat - protects the embryo.
Embryo - new plant.
Food store - contains starch for the embryo plant to grow.



G4. Describe the effect of temperature, water and oxygen on germination.

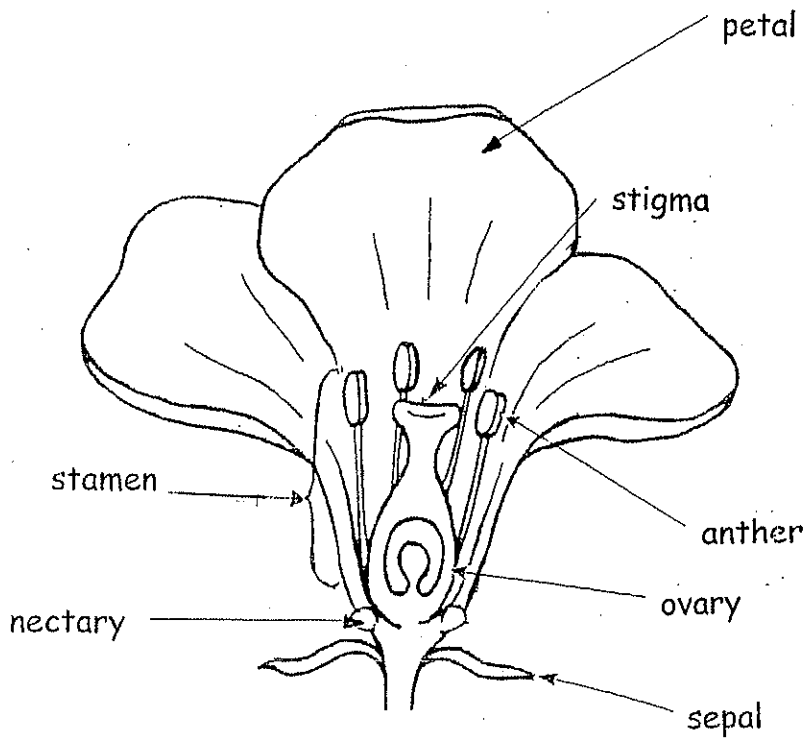
Temperature - seeds need a suitable temperature to germinate.
Water - seeds need water to germinate.
Oxygen - seeds need oxygen to germinate.

G4. What is the definition of germination?

This is when the shoot and root grows out of the seed coat.

G5. Describe the function of the sepal, petal, stamen, anther, stigma, ovary and nectary.

Sepal - protects the flower when it is in a bud.
Petal - brightly coloured to attract insects.
Stamen - this is the male part of the flower.
Anther - contains pollen grains (male sex cell).
Stigma - where the pollen lands.
Ovary - contains the ovule (female sex cell).
Nectary - contains a sugar solution for insects to eat.



G5. What is pollination?
This is when pollen is transferred from an anther to a stigma.

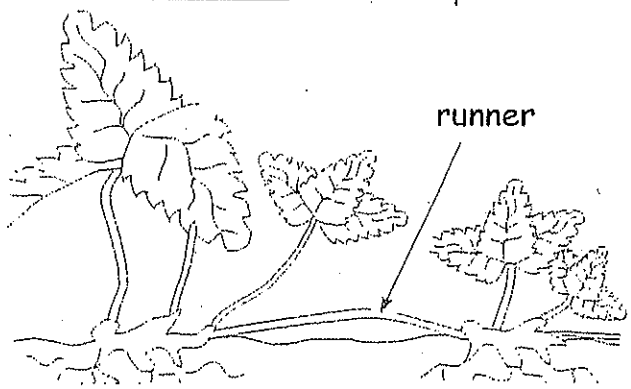
G5. Describe two methods of pollination.
Insect pollination - this is when the pollen sticks to the insect and is carried to the stigma when the insect lands on another flower.
Wind pollination - this is when the large quantity of light pollen grains are carried by the wind to the sticky stigma.

G5. What is fertilisation?
This is when the pollen nucleus joins with the ovule nucleus to form a new cell.

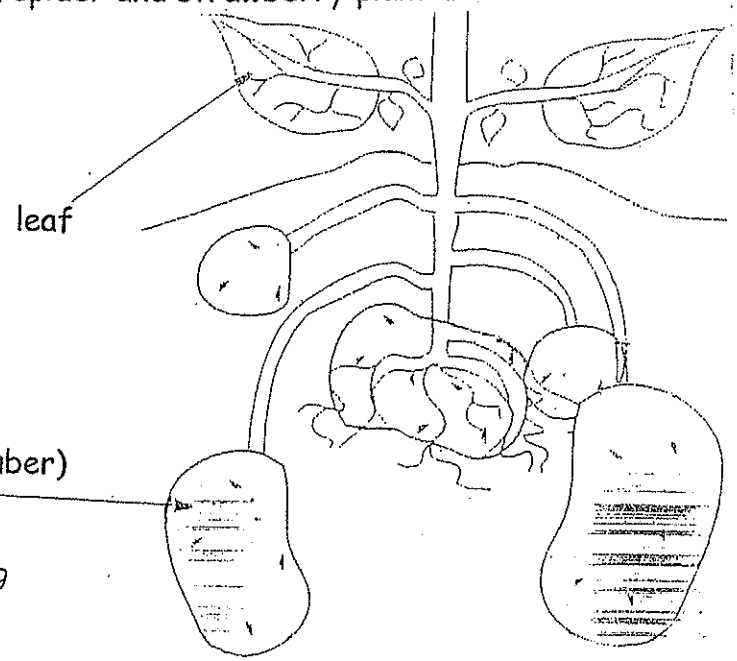
G5. What happens to the flower, ovary and ovule after fertilisation?
Flower - this wilts away and petals fall off.
Ovary - this becomes the fruit.
Ovule - this becomes the seed.

G7. Describe ways of propagating flowering plants artificially by cuttings and grafting.
Cuttings - plants can be cut at the shoots and the shoot is then placed in water so it can grow roots. It is then placed in soil and grows into a new plant.
Grafting - this is when a cutting (a bud or a small branch) is taking from a delicate tree and grafted onto the stem of a hardy disease resistant tree.

G8. Describe asexual reproduction by runners and tubers.



Runner - this is a side shoot which grows out from the parent plant. The new plant develops at the end of the runner and gets food from the parent plant.
E.g. spider and strawberry plants.

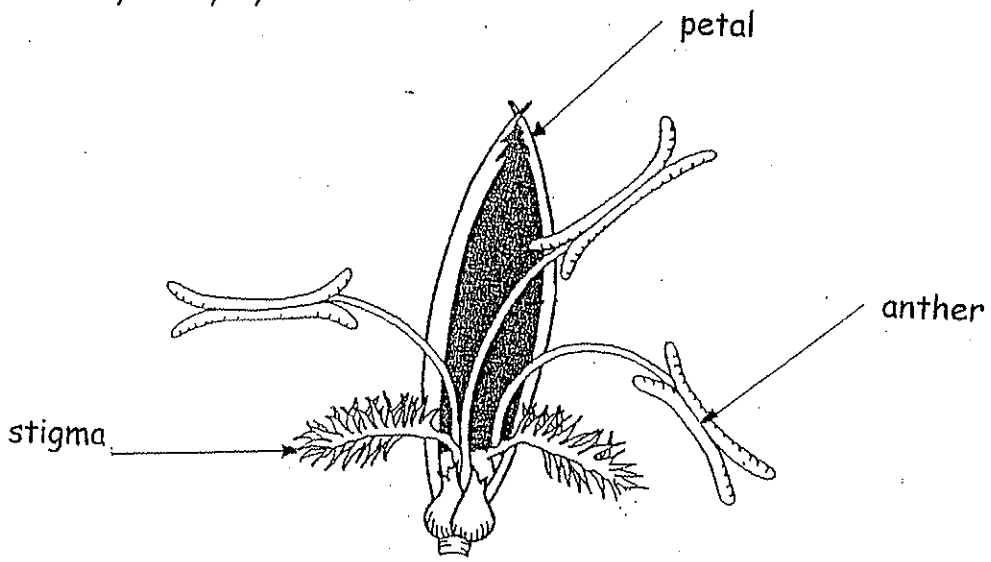


Tubers - the tuber is an underground food store which allows potatoes to survive the winter.

Credit

C4. Describe the changes of percentage germination over a range of temperatures.
There is an increase in germination until a certain optimum temperature, then a decrease in germination.

C5. Explain the structure of wind pollinated plants. Refer to the stigma, petals, anthers and lack of scent.
Stigma - this is sticky and hangs outside to catch the light pollen grains in the wind.
Petals - these are dull and have no scent as they do not need to attract insects.
Anthers - these hang out the flower and are full of light pollen. The pollen can be carried away easily by the wind.



C5. Describe the growth of a pollen tube and joining of gametes.
When the pollen grain lands on a stigma, it grows a pollen tube and moves towards the ovary. The pollen nucleus then joins with the ovule nucleus in the ovary. The male sex cell (pollen) and the female sex cell (ovule) are called gametes.

C6. Name a plant which disperses its seed by either -
a. Wind.
b. Animal internal.
c. Animal external.
Wind - sycamore or ash, Animal internal - apple, orange or walnuts, Animal external - burdock and thistle.

C7. Explain the advantages of artificial propagation in flowering plants.
Artificial propagation is a way of growing plants quicker. All plants are identical to the parent.

C7. What is meant by a clone?
These are plants which are genetically identical to one another.

C8. What is the definition of asexual reproduction? What is the definition of sexual reproduction?
Asexual - this is reproduction using one parent. No gametes made.
Sexual - this is reproduction using two parents. Gametes made.

C8. Describe 2 advantages of both sexual and asexual reproduction in plants.
Sexual - offspring are genetically different.
- offspring are spread out to avoid competition.
Asexual - offspring are identical.
- this is a quicker way of growing plants as the vulnerable stages of growth such as pollination and germination are missed out.

The World of Plants Subtopic c - Making food

General

G9. Explain the need for transport systems in a plant.
Water has to be carried from the roots all over the plant, but especially to the leaves for photosynthesis. Food made in the leaves is used for growth all over the plant and needs to be transported from the leaves.

G9. How is water carried in a plant? How is sugar carried in a plant?
Water is carried by the xylem vessels. Food is carried by the phloem vessels.

G10. What gas do plants take in? What gas do they give out?
Plants take in carbon dioxide and give out oxygen.

G11. What are stomata?
These are pores in the lower surface of the leaf which allow carbon dioxide in and oxygen out.

G11. What else apart from gases is lost through the stomata of a leaf?
Water.

G12. What is the food which plants make called?
Starch.

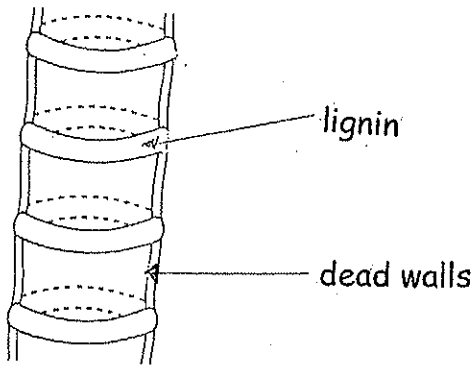
G13. Describe the photosynthesis equation.

$$\text{carbon dioxide + water} \xrightarrow[\text{light}]{\text{chlorophyll}} \text{glucose + oxygen}$$

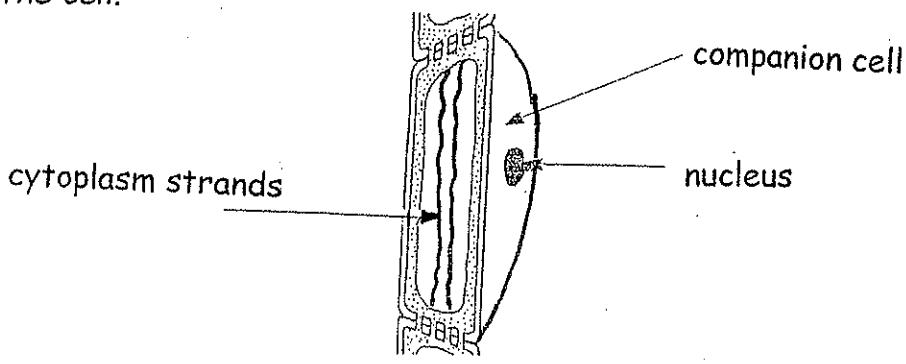
G13. What are the raw materials, essential requirements and products for photosynthesis?
Raw materials - carbon dioxide and water.
Essential requirements - chlorophyll and light.
Products - glucose and oxygen.

Credit

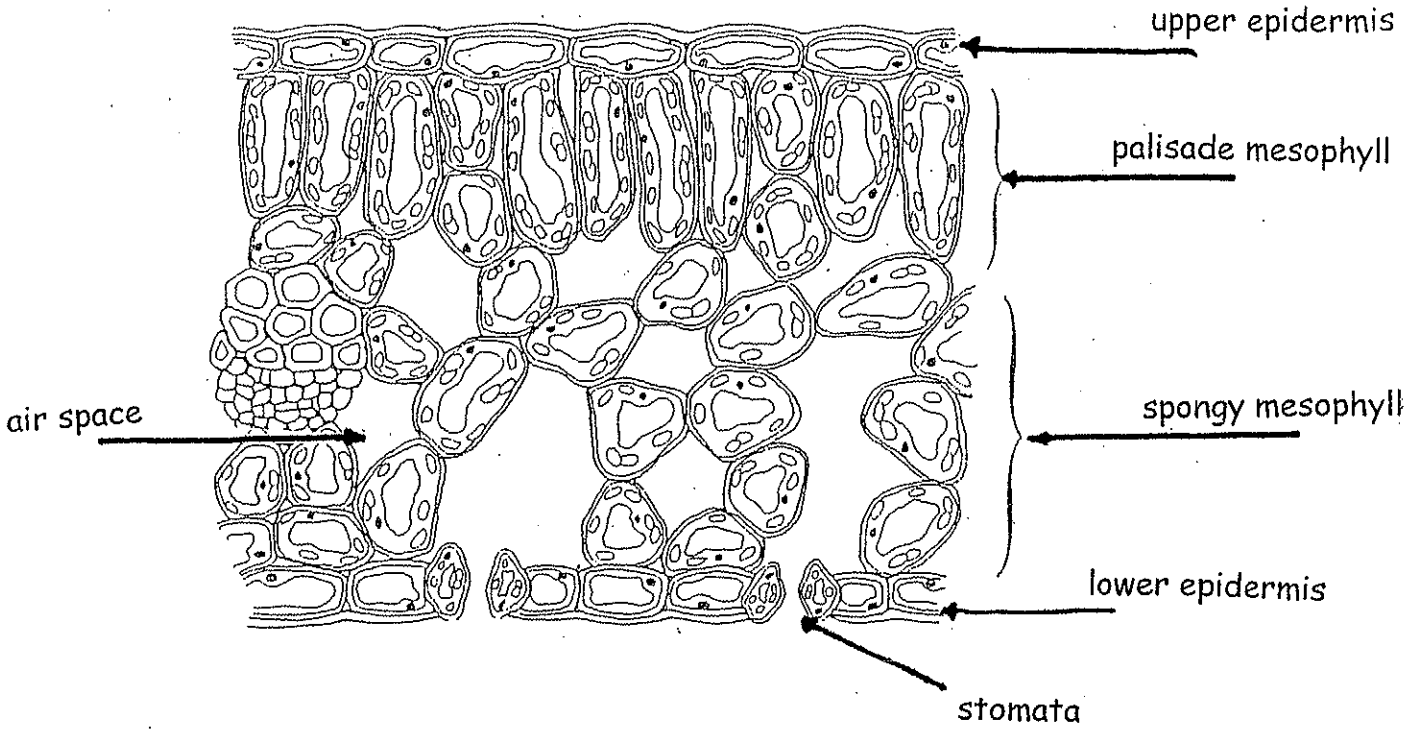
C9. Label the structure of the xylem. What is the function of the dead cell walls and lignin?
Dead walls - these are hollow to allow water to be carried upwards.
Lignin - these are rings which are strong and give the xylem strength.



C9. Label the structure of the phloem. What is the function of the strands of cytoplasm, companion cell and nucleus?
Cytoplasm strands - transports sugar.
Companion cell - controls the phloem cell.
Nucleus - controls the cell.



C10. Label the structure of a leaf including the upper epidermis, palisade mesophyll layer, spongy mesophyll layer, stomata, air spaces and lower epidermis.



Upper epidermis - this is a waterproof layer which reduces water loss.
Palisade mesophyll - full of chloroplasts for photosynthesis.
Spongy mesophyll - have air spaces in them for gas exchange & some chloroplasts.
Air spaces - allow carbon dioxide to dissolve.
Stomata - pores in the leaf to allow carbon dioxide in and oxygen and water out.
Lower epidermis - contains stomata.

C12. Where does the food made by leaves go to?
To any parts of the plant for growth.

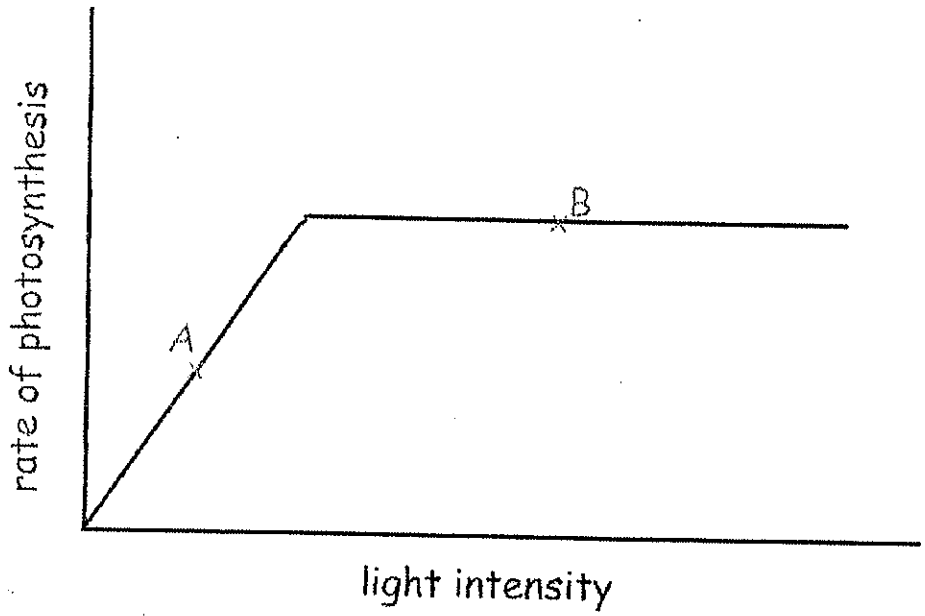
C12. What is the structural carbohydrate in plants?
Cellulose

C12. What is the storage carbohydrate in plants?
Starch.

C13. Explain what is meant by a limiting factor and describe the main limiting factors in photosynthesis.

A limiting factor is something which is in short supply and limits a reaction. In the case of photosynthesis, a limiting factor could be light, carbon dioxide and temperature. If any of these are in short supply the rate of photosynthesis would be limited.

Limiting Factor Graph



C13. In the graph above, what is limiting photosynthesis at point A and point B?

Point A – light intensity.
Point B – temperature or carbon dioxide concentration.

Remember – Whenever the rate of photosynthesis is increasing (the line is going up) the limiting factor is whatever is on the bottom of the graph!
When the rate of photosynthesis is constant (the line is flat) the limiting factor is one of the other 2 options!

Animal Survival Subtopic a - The Need for food

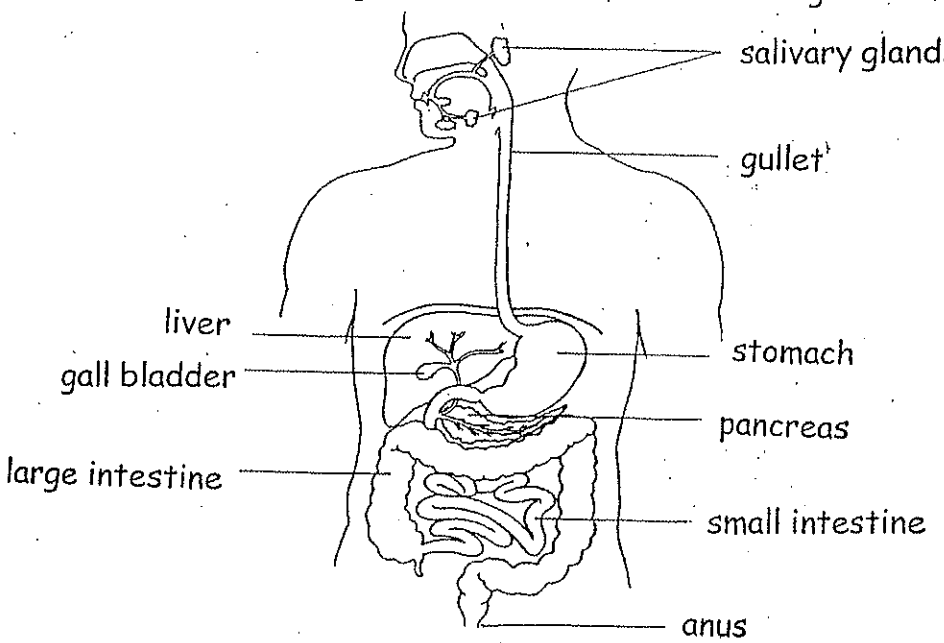
General

G1. Write down 4 reasons we need food.
Movement, heat, growth and repairing wounds.

G2. What is meant by the term digestion?
This is when large insoluble molecules of food are broken down into smaller soluble molecules of food so they can be absorbed through the wall of the small intestine into the blood.

G3. What is the role of incisors, canines, premolars and molars in food breakdown?
Incisors - these are for biting
Canines - these are for tearing
Premolars and Molars - these are for grinding.

G4. Identify the main parts of the digestive system - gullet, salivary glands, stomach, pancreas, liver, gall bladder, anus, small and large intestine.



G5. What enzymes breakdown fats, carbohydrates and proteins?

Food it breaks down	*Enzyme*	*Products of breakdown*	
starch (carbohydrate)	*amylase*	maltose	*(SAM)*
protein	*pepsin*	*peptides or amino acids*	*(P3)*
fats	*lipase*	*fatty acids and glycerol*	*(FLAG)*

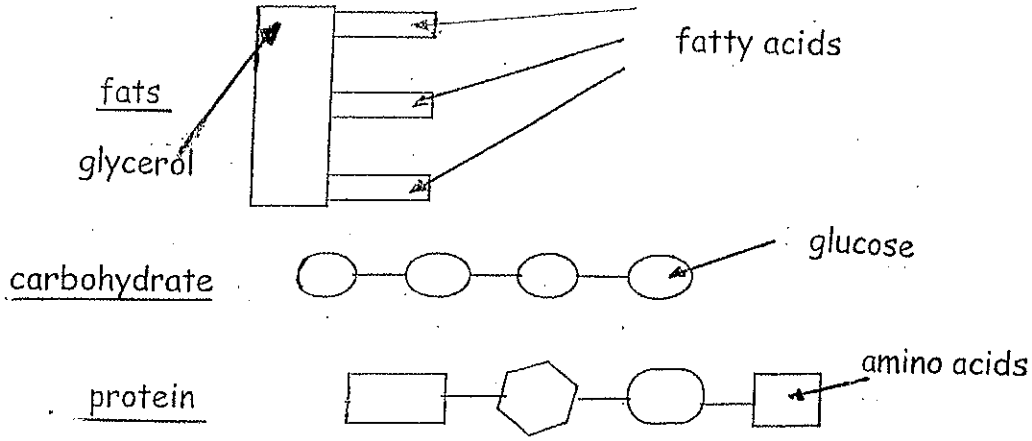
G6. How is the structure of the small intestine related to its function?
Long and folded - to give it a large surface area to absorb food.
Thin walls - to allow dissolved food to pass through it easily by diffusion.
Good blood supply - so large quantities of digested food can pass into the blood.

G7. Describe the role of the large intestine.
Absorbs water. Forms faeces.

Credit

C1. What are the chemical elements in carbohydrates, fats and proteins?
Carbohydrates and fats contain carbon, hydrogen and oxygen (CHO).
Proteins contain carbon, hydrogen, oxygen and nitrogen (CHON).

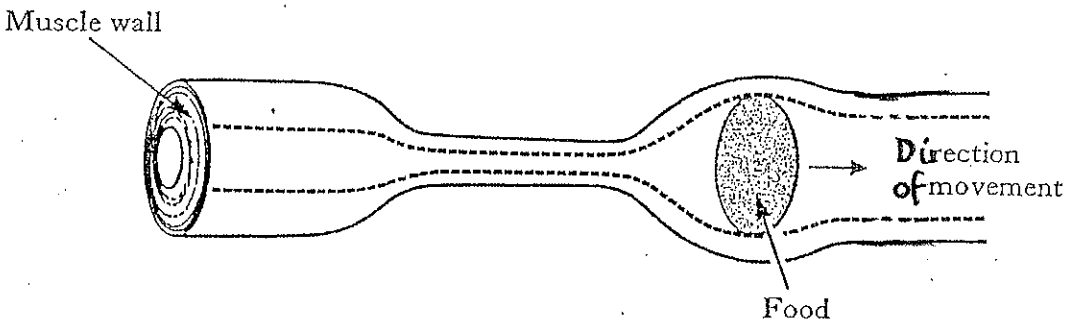
C1. Label the structure of proteins, fats and carbohydrates.



C2. Using the words soluble and insoluble, explain what is meant by digestion.
Digestion is the breakdown of large insoluble particles into small soluble particles that can be absorbed through the wall of the small intestines to the bloodstream.

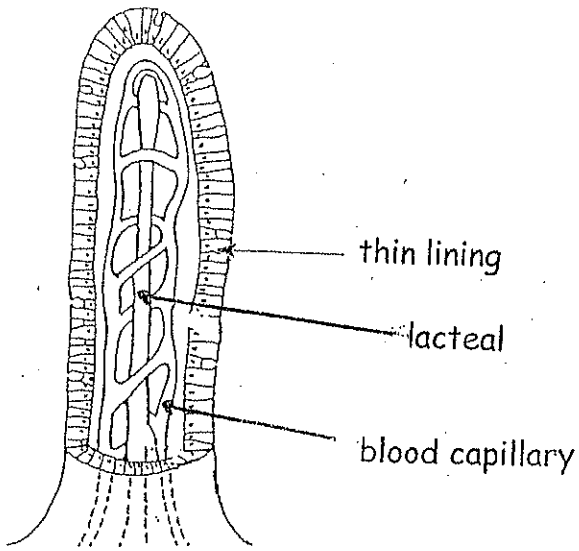
C4. Where are the digestive juices made in the body?
Saliva - amylase. Stomach - pepsin. Small intestine - lipase.

C4. What is peristalsis?
This is the movement of food along the small intestine. Muscles behind the food contract to push food along. Muscles in front of the food relax to push food forward.



C4. How do stomach contractions help digest food?
The contractions churn up the food and enzymes begin to break the food down into smaller particles.

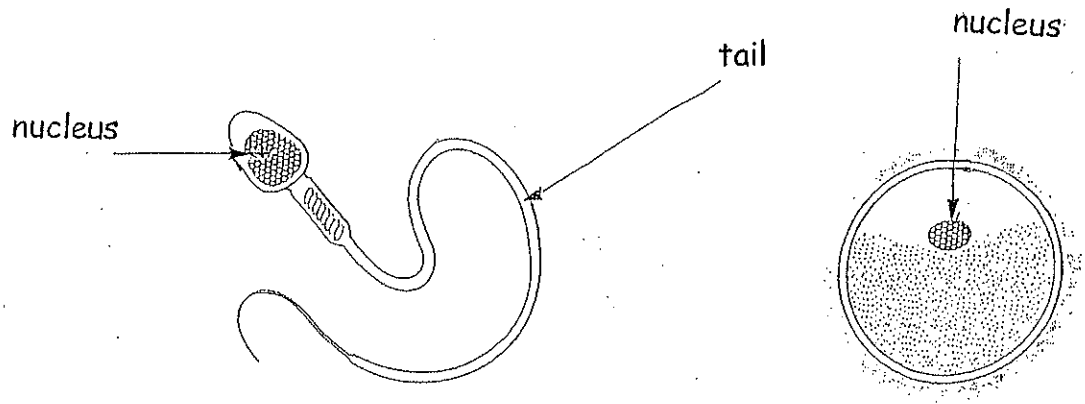
C6. Label the villus below. Explain how the structure of the lacteal, blood capillaries and thin lining are related to its function.
Lacteal - absorbs fats.
Blood capillaries - absorbs glucose and amino acids.
Thin lining - allows all food to pass into the villus easily.



The Need for food Subtopic b - Reproduction

General

G8. Know the parts of the sperm and egg.



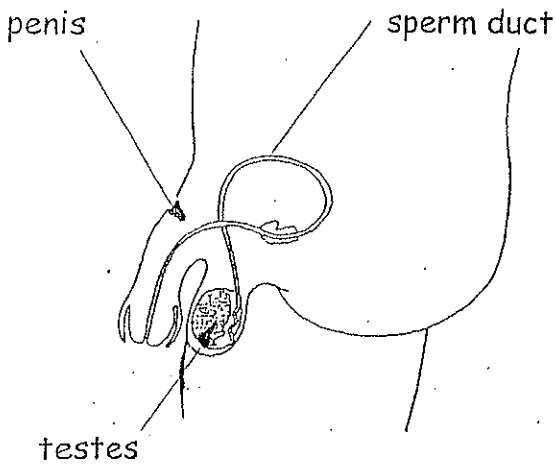
G9. Describe the process of fertilisation.
Fertilisation is when the sperm nucleus joins with the egg nucleus to make a zygote.

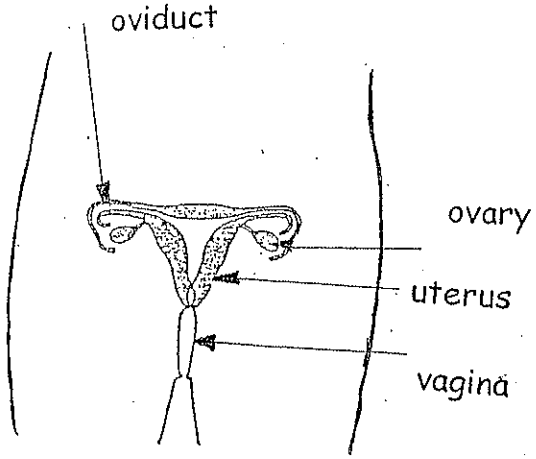
G9. In fish reproduction, where are sperm placed?
In the water, adjacent to the females eggs.

G9. In mammals, where are sperm placed?
In the female's body.

G9. Where does fertilisation take place in animals?
In the oviduct.

G10. Where are sperm cells made? Where are eggs made?
Sperm - in the testis. Eggs - in the ovary.



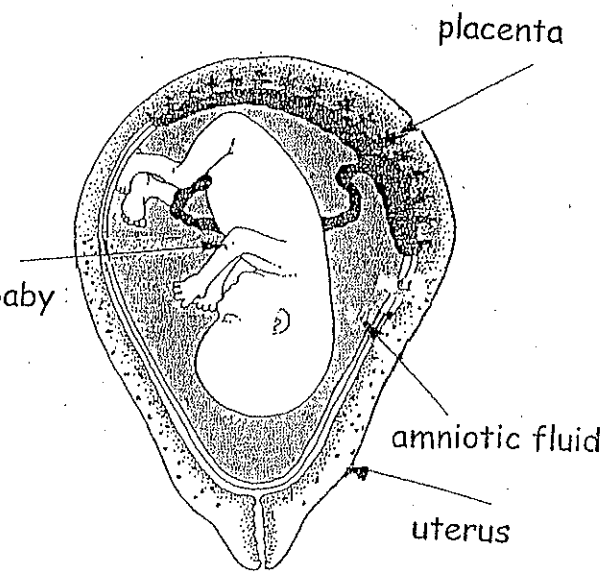


G11. Where does the fertilised egg go? What is the structure it embeds into?
The fertilised egg divides and goes to the uterus (womb). It embeds in the wall of the uterus and grows into an embryo.

G11. What protects the baby in the womb?
The amniotic fluid.

G11. Where does the baby get its food from?
The mothers blood.

G11. What protects fish eggs?
A flexible covering.



G12. Where does a fish embryo obtain its food?
From the yolk sac.

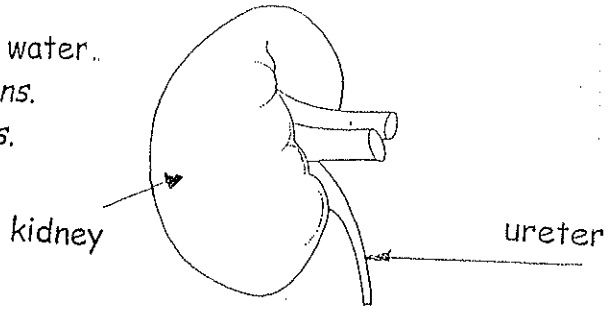
G12. Where does a young fish get its food from?
The water. It does not rely on its parents for food and protection.

G12. *Where do young mammals get their food and protection from?*
Their parents.

The Need for Food Subtopic c- Water and Waste

General

G13. Identify 2 ways animals gain water and lose water.
Gain water - drinking, eating and chemical reactions.
Lose water - breathing, sweating, urine and faeces.



G14. Where is water regulated in an animal?
kidneys.

G15. What is the function of the kidney, renal arteries, renal veins, ureter and bladder? What is a nephron?

Renal artery - carries blood to the kidney.

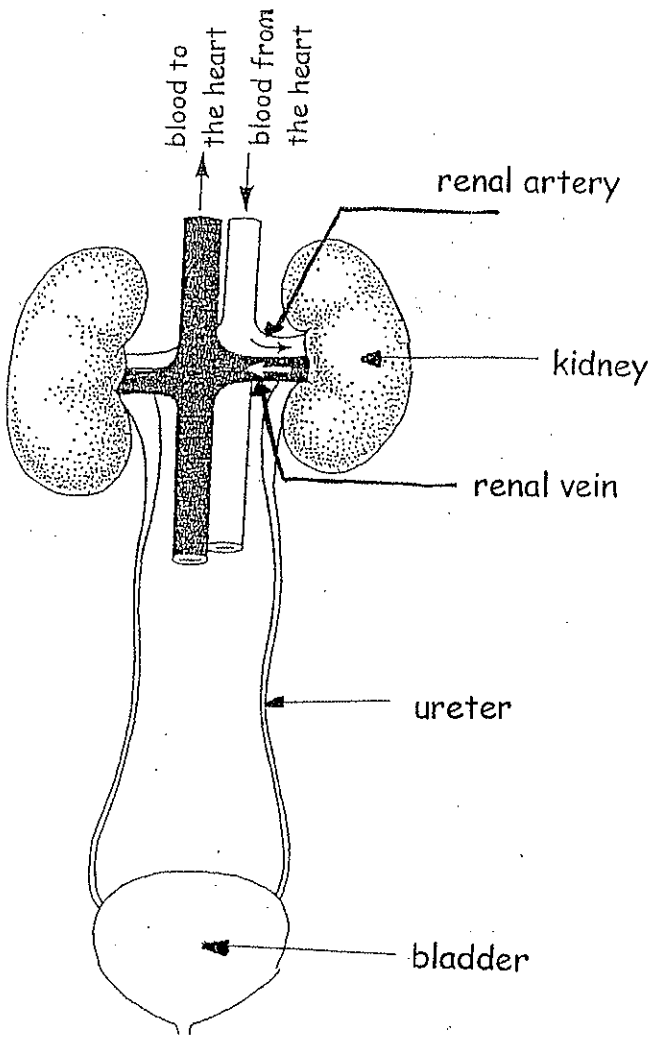
Renal vein - carries blood away from the kidney.

Ureter - carries urine to the bladder.

Bladder - stores urine.

Nephron - the filtering unit of the kidney.

Kidney - removes waste and controls water balance.



G15. What two things does the kidney reabsorb?
Glucose and amino acids.

G16. What is meant by reabsorption? What is meant by filtration?
Reabsorption - kidney reabsorbs useful glucose, amino acids and some water from the tubule and puts them back into the blood.
Filtration - kidney filters out small substances in the glomerulus and gets rid of poisonous substances like urea.

G15. What is urea?
This is a poisonous substance produced from the breakdown of unwanted amino acids.

G15. What are the final substances in urine?
Urea, water and some salt.

G16. What happens if there is damage with your kidney?
Urea builds up and you will die if the waste is not removed.

<u>Credit</u>

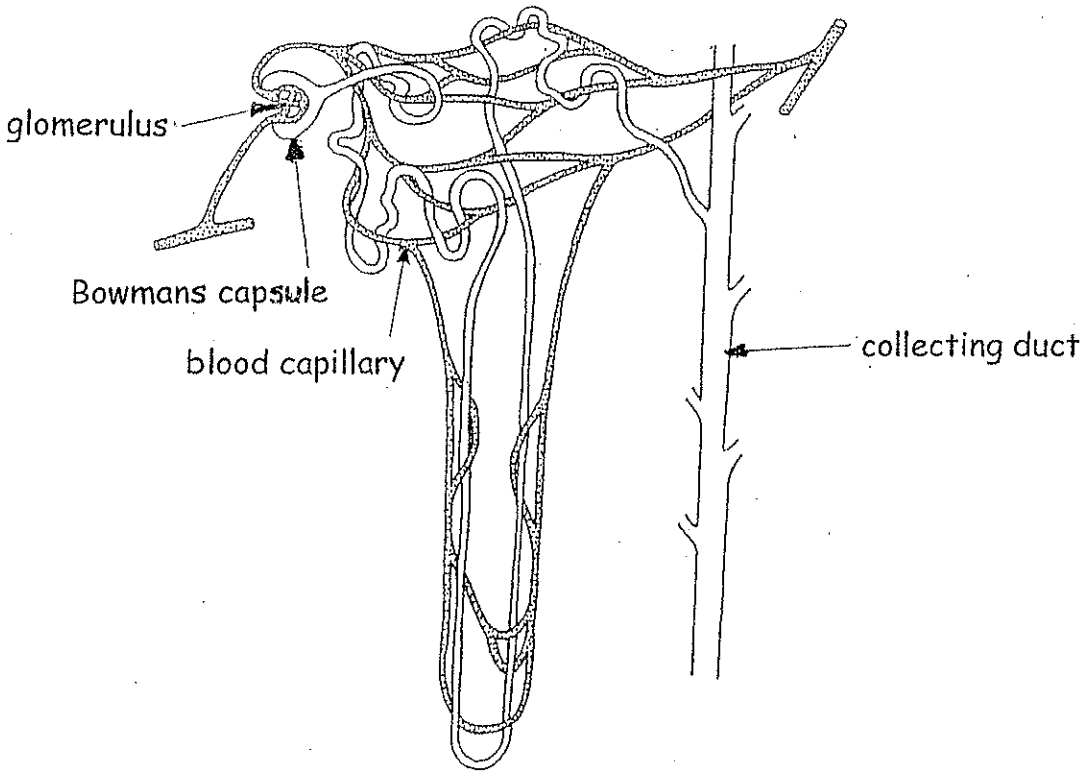
C14. What is ADH? What does it do to the kidney tubules?
This is anti diuretic hormone. It controls the concentration of water in the blood. *Low levels of ADH cause less water to be reabsorbed back into the blood by the kidney and a lot of dilute urine to be made.*
Higher levels of ADH in the blood causes more water to be reabsorbed back into the blood by the kidney and a small concentrated volume of urine is made.

C14. What happens to the levels of ADH when you do not have enough water in your blood say after a salty meal or excess sweating during exercise?
ADH levels are high to absorb water from the kidney tubule back into the blood.

C14. What happens to ADH levels in the blood if you drink lots of water?
ADH levels are low to have little water reabsorbed in the blood.

C15. Where does urea come from? Why does it have to be removed?
Urea comes from unwanted amino acids. It is removed from the blood by the kidney and placed in urine. Urea is very poisonous and dangerous.

C15. Explain the process of urine production, starting with the bowmans capsule, glomerulus, blood capillaries, collecting ducts and bladder.
Glomerulus - filters the blood (protein stays in the blood) with water, glucose and urea being forced out of the blood.
Bowmans capsule - collects the filtrate containing water, glucose and urea.
Blood capillaries - reabsorb *useful substances like water and glucose.*
Collecting ducts - gather urine from several nephrons.
Bladder - stores urine.



C16. Give an example of a benefit and limitation in having a kidney machine. Give an example of a benefit and limitation in having a kidney transplant.
Kidney machine benefit - keeps patient alive and there is no kidney rejection.
Kidney machine limitation - long time spent on the machine.
Transplant benefit - a normal life is lead.
Transplant limitation - there are a lack of donors and the kidney may be rejected.

Animal Survival Subtopic d Responding to the environment

General

G17. Give two examples of factors which affect behaviour. Describe the response of the animal to change.
Light - maggot moves away from the light (this increases its chance of finding food, moisture and shelter).
Humidity - woodlouse moves fast where the area is dry and slowly where the area is moist (will move fast to escape from areas where they can dry out and hope to find a damp area instead).

G18. What is rhythmical behaviour? Give an example of a daily rhythmical behaviour and seasonal rhythmical behaviour.
Tidal - limpet will attach to rocks at low tide and move about at high tide (this stops it drying out and allows it to find food).
Daily - owl sleeps in the day and is active at night (finds food at night).
Annual - swallow migrates south in winter and north in the summer (for food and a suitable temperature). A bear hibernates in the winter to conserve energy when there is little food.

Credit

C17. Woodlice stay in the dark where it is sheltered and damp. Explain the significance of this behaviour to the stimuli darkness and dampness.
Darkness is important as the woodlouse feels safe and hidden from predators.
Dampness is important as the woodlouse will not dry out.

C18. Explain the significance of tidal rhythmical behaviour to animals in the sea.
Some animals will feed at high tide and cling to rocks at low tide so they are not swept away or allowed to dry out.

Investigating cells subtopic a - Investigating Living Cells

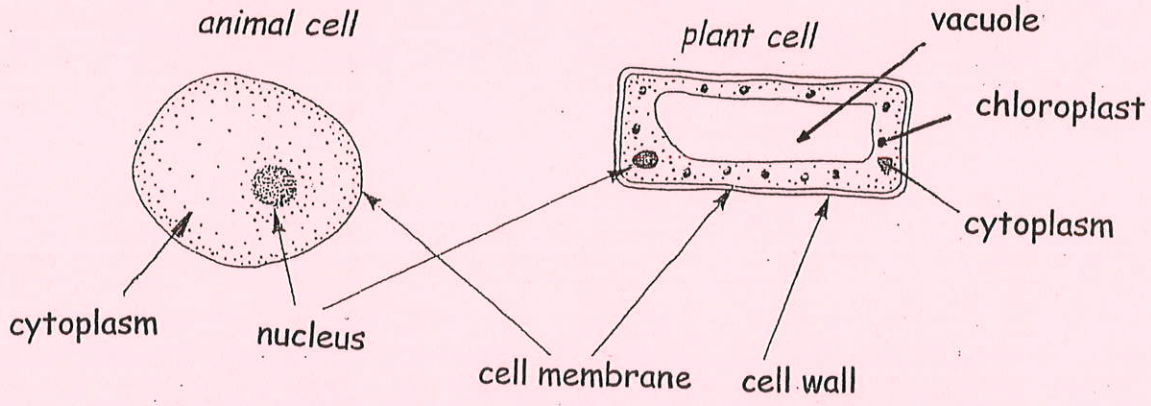
General

G1. What are the basic units of living things called?
Cells.

G2. Why is it important to stain cells?
It helps to show up the structures more clearly.

G3. What 3 structures do all cells have in common? What three structures are present in plant cells only?
All cells have a nucleus, cell membrane and cytoplasm.
Plant cells have also a cell wall, chloroplasts and a vacuole.

G3. What is the function of the membrane, cell wall, cytoplasm, nucleus, chloroplast and vacuole?
Membrane - controls what enters and leaves the cell.
Cell wall - gives the plant cell shape/support.
Nucleus - controls the cells activities and holds genetic information.
Chloroplasts - photosynthesis occurs here.
Vacuole - gives support and holds a sugary watery solution.
Cytoplasm - where chemical reactions take place.



Investigating cells subtopic b - Investigating diffusion

General

G4. What is meant by the term diffusion in cells?
This is the movement of a substance from a high concentration to a low concentration along a concentration gradient.

G5. Give two examples of substances which can enter and leave a cell.
Food, oxygen and carbon dioxide.

G5. What controls the movement of substances in and out of the cell.
Cell membrane.

G6. What is osmosis?
This is the movement of water from a high concentration to a low concentration through a selectively permeable membrane. This is a special case of diffusion.

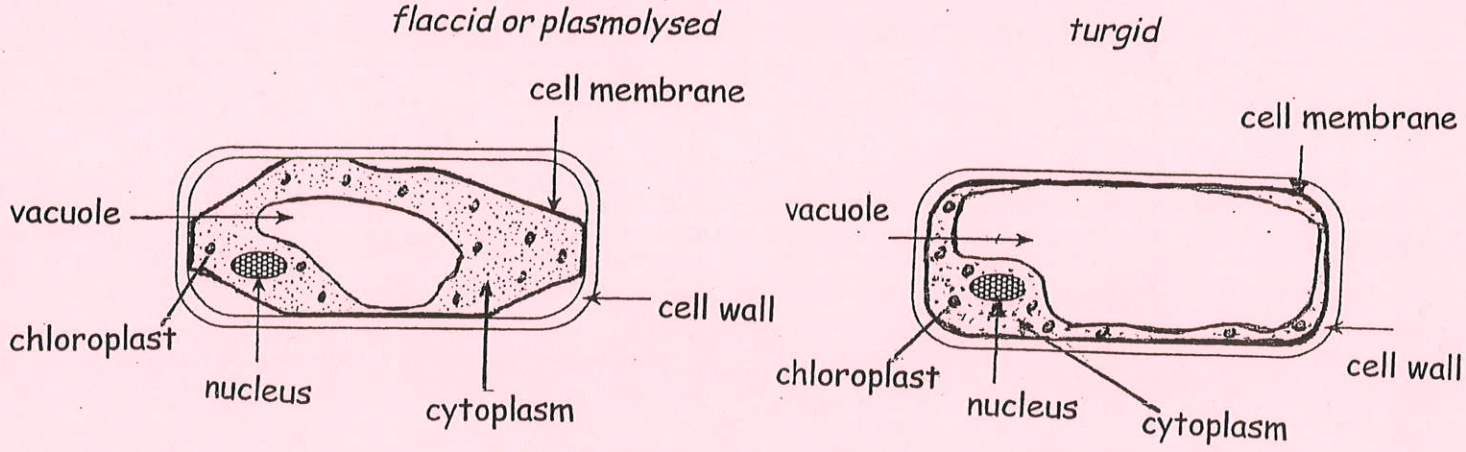
Credit

C4. Explain the importance of diffusion to organisms.
This allows oxygen, water and food to enter cells.

C6. Explain osmosis using the words "selectively permeable" and "concentration gradient".
This is the movement of water from a high concentration to a low concentration (along a concentration gradient) through a selectively permeable membrane.

C7. What happens when a cell is placed in water? What is meant by the term turgid?
A plant cell's vacuole will gain water. The plant cell will become turgid.
An animal cell will burst as it has no cell wall for strength.

C7. What is meant by the terms flaccid or plasmolysed?
This is when a plant cell has lost water. The vacuole has shrunk.



Investigating Cells subtopic c - Investigating Cell Division

General

G8. What part of a cell controls cell division?
Nucleus.

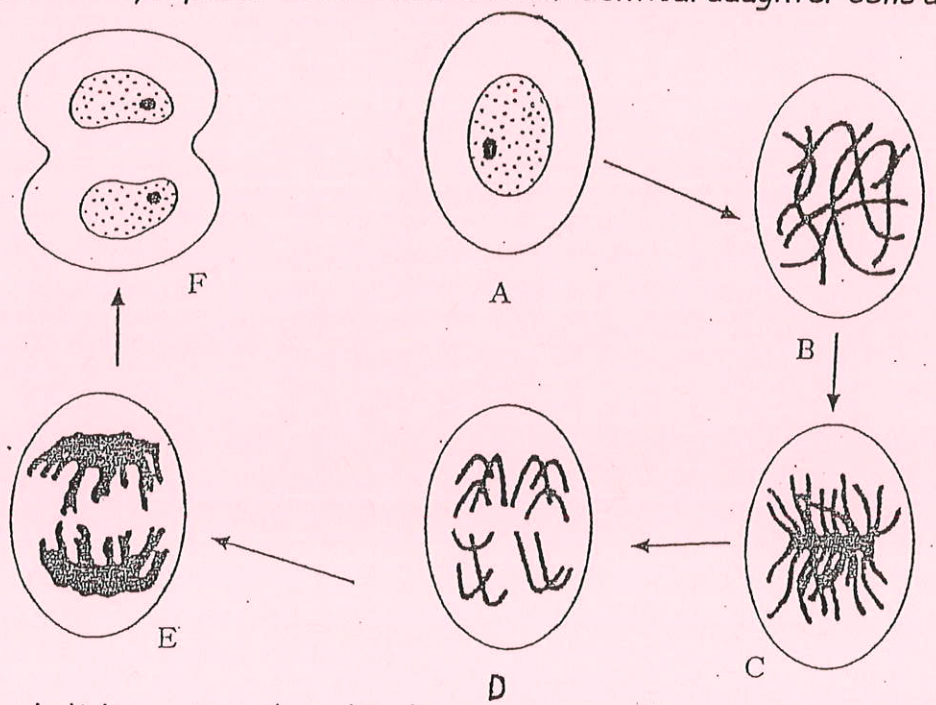
G8. Why do cells need to divide?
This is a way of increasing the number of cells in an organism.

G9. Do the new cells made by mitosis have a complete set of chromosomes with the same information as the parent cell?
Yes.

G10. Know the correct sequence of cell division.
See diagram C9.

Credit

C9. Describe the main stages of mitosis by a diagram.
Stage A. Nucleus containing long uncoiled chromosomes.
Stage B. Chromosomes shorten and thicken to form chromatids.
Stage C. Chromatids line up at the equator (middle) of the cell.
Stage D. Chromatids are pulled apart to opposite sides of the cell.
Stage E. Separate chromatids are now called chromosomes.
Stage F. The cytoplasm divides and two new identical daughter cells are made.



C9. Why is it important that the chromosome complement of daughter cells is maintained?
So no information is lost. The cell can function properly.

Investigating cells subtopic d - Investigating enzymes

General

G11. Why are enzymes important for cells?
They speed up chemical reactions.

G11. What is meant by a catalyst?
A catalyst speeds up a chemical reaction. Enzymes are biological catalysts.

G12. Give an example of an enzyme involved in a chemical breakdown.

hints

hydrogen peroxide —(*catalase*)→ *oxygen and water.* *hpcow*

starch —(*amylase*)→ *maltose* *sam*

fats —(*lipase*)→ *fatty acids and glycerol* *flag*

protein —(*pepsin*)→ peptides *p3*

G13. Give an example of an enzyme involved in synthesis.

glucose - 1 phosphate —(*phosphorylase*)→ *starch* *g1pps*

Phosphorylase is the enzyme.

G14. What are enzymes made of?
They are made of protein.

G14 What happens to the activity of enzymes as the temperature increases.
There is an increase in activity until the enzyme reaches its optimum and then a decrease. At high temperatures (above 50'C) the enzyme stops working. The enzyme has been denatured.

G14. Do all enzymes work at the same temperature and pH?
No. Enzymes have a particular working range.
Pepsin - pH range of 1-4 with an optimum pH of 2.5.
Catalase - pH range of 7-10 with an optimum pH of 9.

Credit

C11. Enzymes are specific. What is meant by this term?
One enzyme will act only on one substrate e.g amylase will only work on starch.

C14. Explain the term optimum with enzyme reactions.
Optimum conditions are those at which an enzyme works best at.

Investigating Cells subtopic e - Investigating Aerobic Respiration

General

G15. Give three reasons why living cells need energy.
Growing, making new cells and movement.

G17. What gas do cells need to release energy?
Oxygen.

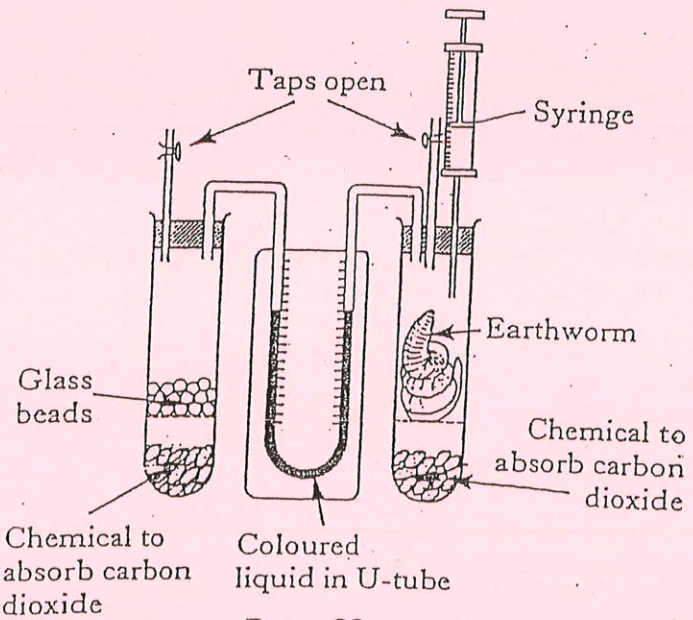
G17. Write down the aerobic respiration equation.
glucose + oxygen ⟶ energy + carbon dioxide + water

G18. What gas is breathed out during respiration? Where does this come from?
Carbon dioxide is breathed out and comes from respiration

G19. When germinating peas are put in a flask, what happens to the temperature?
Heat is released when the peas respire. This temperature increase is detected by the thermometer.

Extra questions

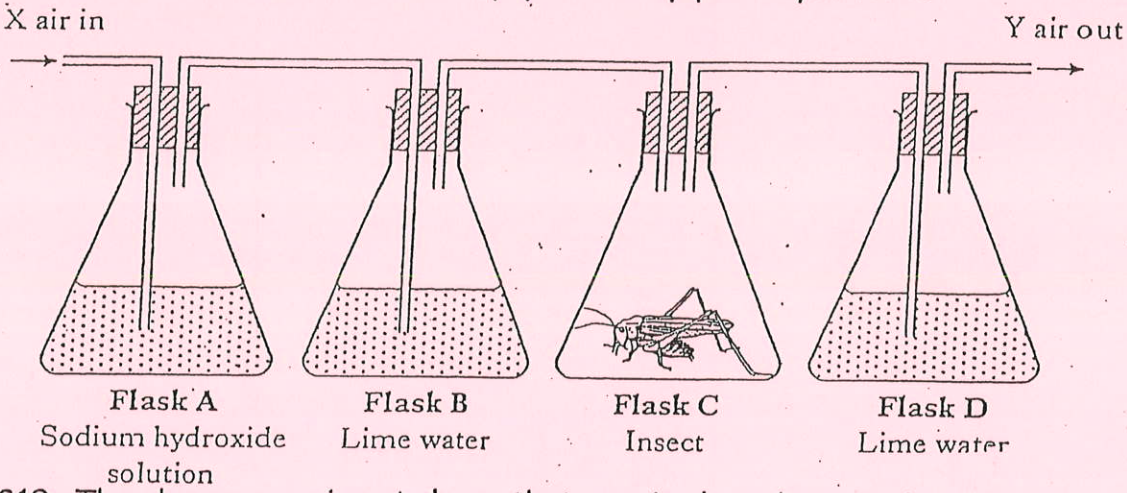
G19. Respirometers are equipment which measure respiration. Why do you use cold blooded animals and not warm blooded animals?
Warm blooded animals heat up the coloured liquid and affect its volume.



G19. Why is the tubing narrow in a respirometer?
So very small movements of the liquid can be detected (more accurate).

G19. Why are the pellets of chemical to absorb carbon dioxide placed under the animal?
These are kept away from the animals as they are poisonous.

G19. Why would you not use a green plant in the respirometer? How could you adapt the experiment to be able to measure respiration in plants?
Green plants would use oxygen they make during photosynthesis so it may appear that they are not respiring because the liquid might not move. You could cover the tube with black paper to stop photosynthesis.



G19. The above experiment shows that an animal produces carbon dioxide when it repspires. Why does flask A have sodium hydroxide solution and flask B have limewater?
Sodium Hydroxide absorbs any carbon dioxide in the air that the animal breathes in.
The limewater in flask B should not turn milky to prove that any there is no carbon dioxide in the air that the animal can breathe in.

G19. What colour should the limewater in flask D turn?
It should become milky/cloudy proving the insect is breathing out carbon dioxide produced during respiration.

Credit

C16. From fats, proteins or carbohydrates which contains more energy per gram?
Fats.

C19. What is meant by the term metabolism? Why is it important that energy is released in small amounts?
The sum of all chemical processes in a cell is called metabolism. Energy is released in small amounts as large amounts of energy release is dangerous.

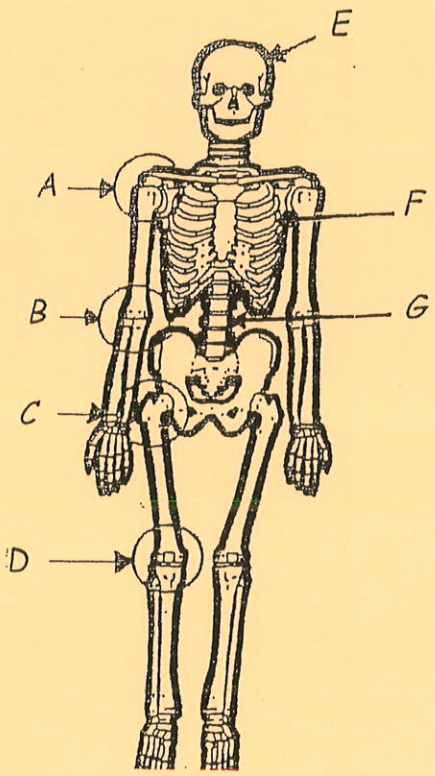
The Body in Action Subtopic a Movement

General

G2. Name three functions of the skeleton.
Support, protection, attachment of muscles and movement HINTS - SPAM.

G2. What part of the skeleton protects the brain, spinal cord and heart?
Brain - skull.
Spinal cord - back bone.
Heart - rib cage.

A - Ball and socket joint in the shoulder
B - Hinge joint in the elbow
C - Ball and socket joint in the hip
D - Hinge joint in the knee
E - Skull
F - Rib cage
G - Back bone



G3. Joints allow movement. Which joint allows movement in <u>one plane only</u>?
The hinge joint is found in the knee and elbow.

G3. Which joint allows movement in <u>more than one plane</u>?
The ball and socket joint is found in the hip and shoulder.

G3. What is the function of ligaments and cartilage in a joint?
Ligaments - holds bones together.
Cartilage - cushions and protects the bone ends.

G4. What is bone made of?
Flexible fibres and hard minerals.

G5. What holds muscles to bones?
Tendons.

G6. How does muscle contraction cause movement?
When muscles contract they shorten. This causes movement. When muscles relax they get longer. This causes no movement.

Extra questions

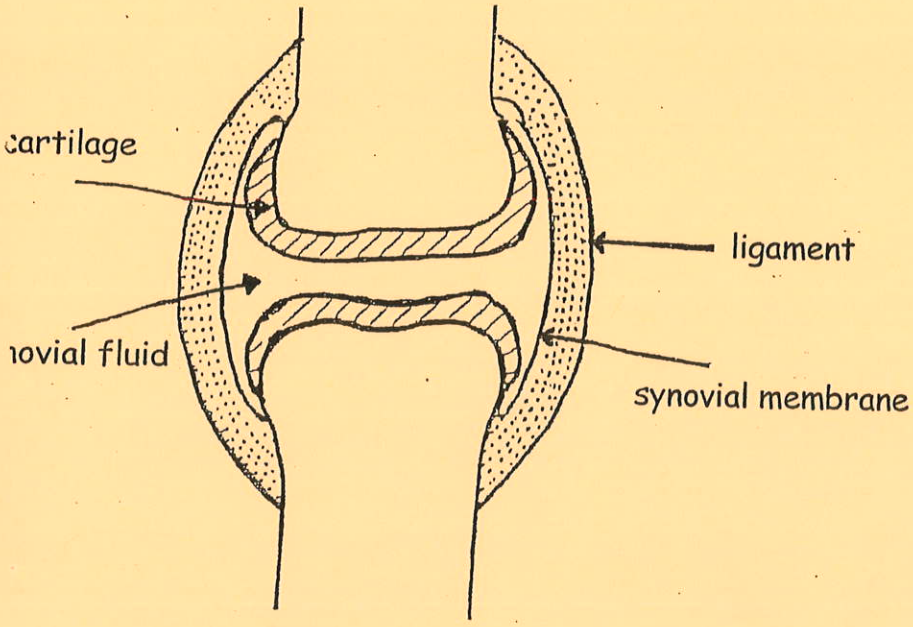
G5. What happens when bone is soaked in acid? Which part of the bone has been removed?
The bone becomes soft. The hard minerals are removed by acid.

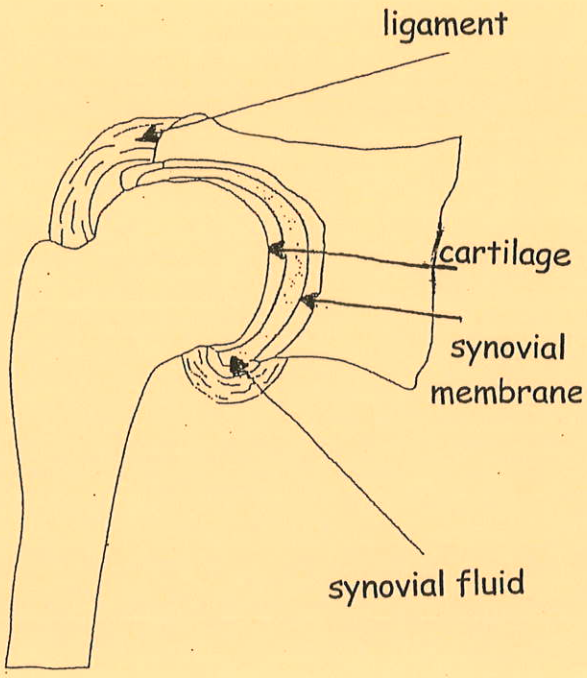
G5. What happens when bone is burnt? Which part of the bone is removed?
The bone becomes brittle. The flexible fibres have been destroyed by heat.

Credit

C3. Label the joint. Describe the functions of the different parts of the joint.

Part	*Function*
Synovial Membrane	*secretes synovial fluid.*
Synovial fluid	*lubricates and cushions.*
Cartilage	*cushions and protects the bone ends.*
Ligament	*holds bones together.*





C4. How is bone formed?
From living cells. It has its own blood supply.

C5. Why are tendon inelastic?
So the force made by the muscle can be transferred to the bone.

C6. Why do we need opposing pairs of muscles?
These must be arranged as an antagonistic pair (opposing) to allow bending and straightening. One muscle contracts and the other relaxes to allow movement.

Extra questions

C6. Describe what happens to the biceps and triceps when the arm is bent.
The biceps contract and the triceps relax.

C6. Describe what happens when the arm is straightened.
The biceps relax and the triceps contract.

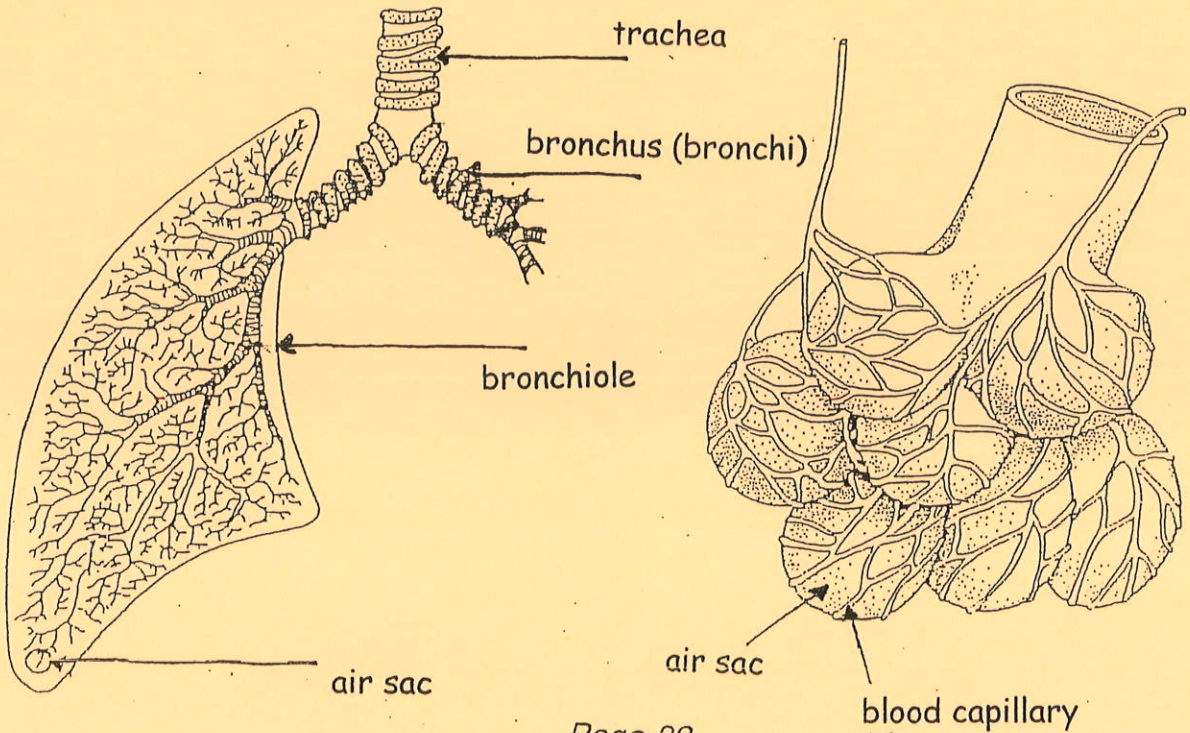
Body in Action Subtopic b The Need for Energy

General

G7. If your input of energy is greater than your output do you gain or lose weight?
Gain weight.

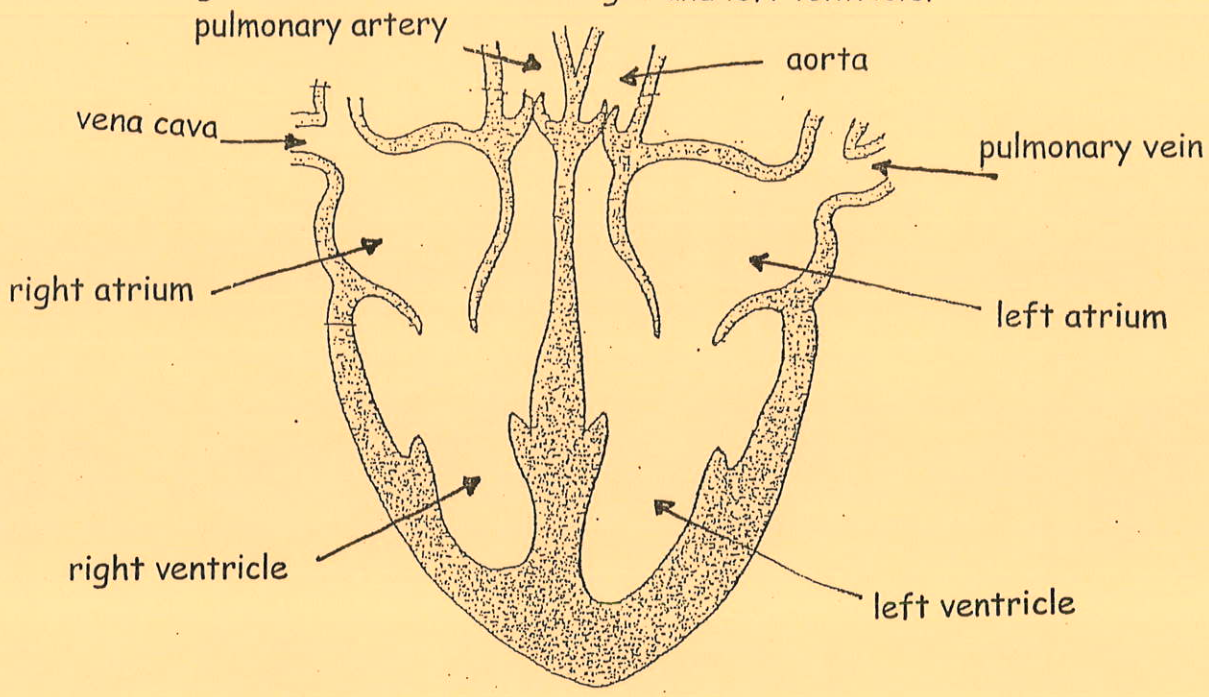
G8. What gas is absorbed when you breathe in? What gas is released when you breathe out?
Oxygen is absorbed when you breathe in and carbon dioxide is released when you breathe out.

G9. Know the lung structure including the labelling of the trachea, bronchi, bronchioles and air sacs.



G10. Name the 4 chambers of the heart. Describe the path of blood as it travels through the heart.

There is a right and left atrium and a right and left ventricle.



Blood passes through the vena cava, right atrium, right ventricle, pulmonary artery, pulmonary vein, left atrium, left ventricle to the aorta.

G10. Describe the position and function of the heart valves.

There are valves between the atria and ventricles and valves between the ventricles and arteries that leave the heart. Valves allow blood to travel in one direction only.

G10. Why is the left ventricle wall thicker than the right ventricle wall?

The left hand side of the heart pumps blood all around the body whereas the right hand side of the heart only pumps blood to the lungs.

G10. The heart has its own blood supply. What is it called and why is it needed?

The coronary artery is needed to supply the heart muscles with oxygen and food.

G11. Name the three types of blood vessels in the body. What are their functions?

Arteries - takes blood away from the heart.

Capillaries - allow food and oxygen to the pass from the blood to the body cells. These also remove the waste from the body cells.

Veins - return the blood back to the heart.

G11. What is a pulse?
This is blood flowing through an artery.

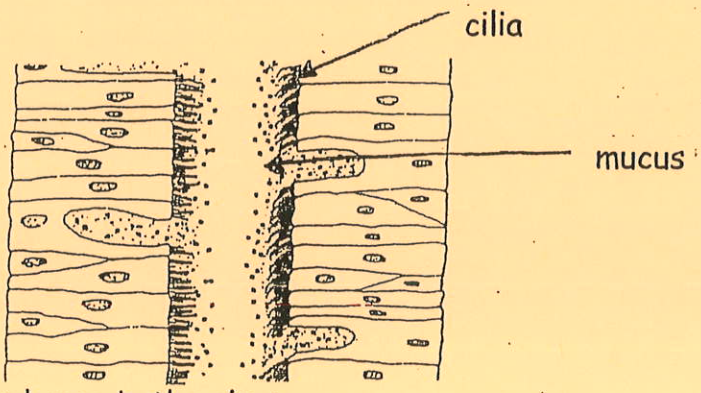
G12. What is the function of red blood cells and plasma?
Red blood cells carry oxygen around the body. Plasma contains dissolved carbon dioxide and food.

G12. What gas diffuses from red blood cells to the body tissue? What gas diffuses from the body tissue to the plasma to be breathed out.
Oxygen diffuses out of the red blood cells to the body cells.
Carbon dioxide diffuses out from the body cells to the plasma.

Credit

C9. When we breathe in, what happens to the volume and pressure of the lungs, the ribcage, intercostal muscles and the diaphragm?
Lung volume increases.
Lung pressure decreases.
Intercostal muscles contract.
Rib cage moves up and out
Diaphragm contracts and flattens.

C9. What is the function of cilia, cartilage and mucus in the trachea and bronchi?
Cartilage - these are rings which keep the trachea open.
Mucus - this is a sticky fluid which traps dust and germs.
Cilia - these are tiny hairs which move mucus up and out of the air passages to be swallowed.



C9. Describe gas exchange in the air sacs.
Oxygen moves from a high concentration in the air sacs to a low concentration in the blood.
Carbon dioxide moves from a high concentration in the blood to a low concentration in the air sacs.

C9. Describe three features which make the lungs efficient at gas exchange.
Good blood supply - transport of gases.
Moist - to allow gases to dissolve.
Thin - to allow diffusion of gases more easily.
Large surface area - to allow more gases to diffuse at one time.

C12. What is the function of haemoglobin?
This is the chemical in red blood cells which carries oxygen.

high oxygen conc (lungs)

haemoglobin+oxygen ⟶ oxyhaemoglobin

⟵

low oxygen conc (body cells)

C12. Capillaries are specially adapted for gas exchange. Name two ways they are adapted.
Capillaries are thin walled to allow diffusion of gases more easily.
Capillaries are close to body cells to allow rapid diffusion.
Capillaries have a large surface to increase diffusion.

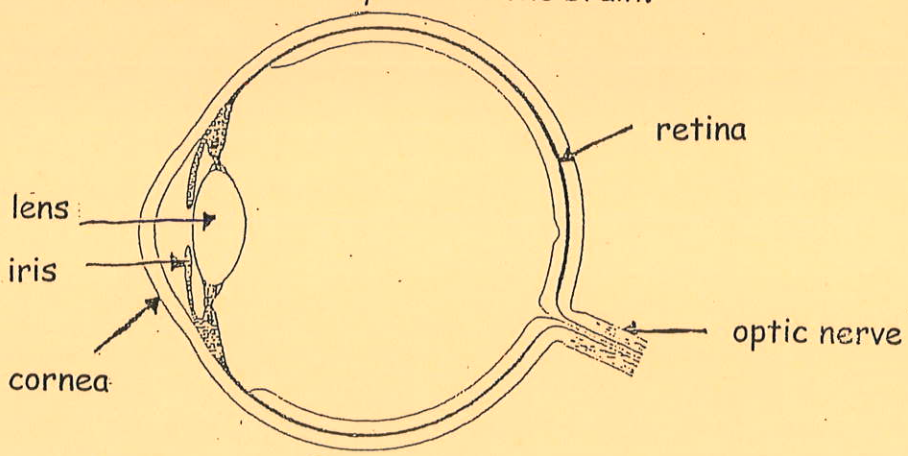
Body in Action Subtopic c Co-ordination

General

G14. State that it better to judge distance with two eyes instead of one.
Judging distances are better with two eyes rather than only one.

G15. Describe the functions of the different parts of the eye.

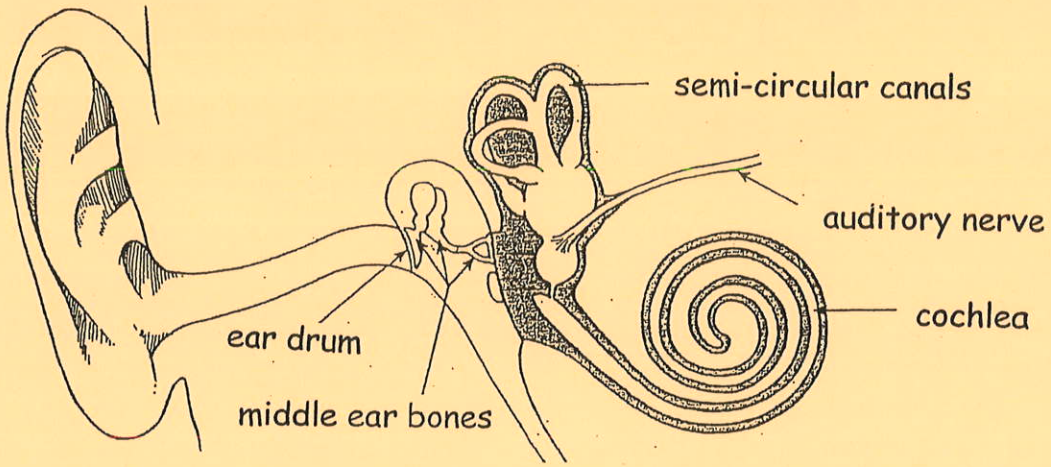
Part of the eye	*Function*
cornea	*lets light into the eye.*
iris	*controls the amount of light entering the eye.*
lens	*focuses light onto the retina.*
retina	*changes light impulses into nerve impulses for the brain.*
optic nerve	*carries nerve impulses to the brain.*



G16. State that the judgment of the direction of sound is better with two ears instead of only one.
Judging the direction of sound is better with two ears instead of only one.

G17. Describe the functions of the different parts of the ear.

Part of the ear	*Function*
eardrum	*passes sound vibrations to the ear bones.*
middle ear bones	*amplifies sound vibrations.*
cochlea	*changes sound vibrations into nerve impulses.*
auditory nerve	*carries nerve impulses to the brain.*
semi circular canals	*balance.*



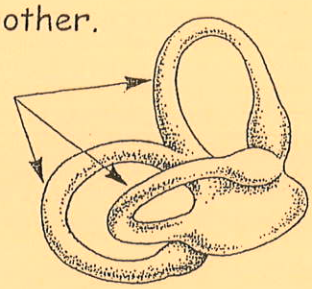
G18. What is the nervous system made up of?
Brain, spinal cord and nerves.

G19. What is the function of nerves?
These carry information from the senses to the central nervous system and from the central nervous system to the muscles.

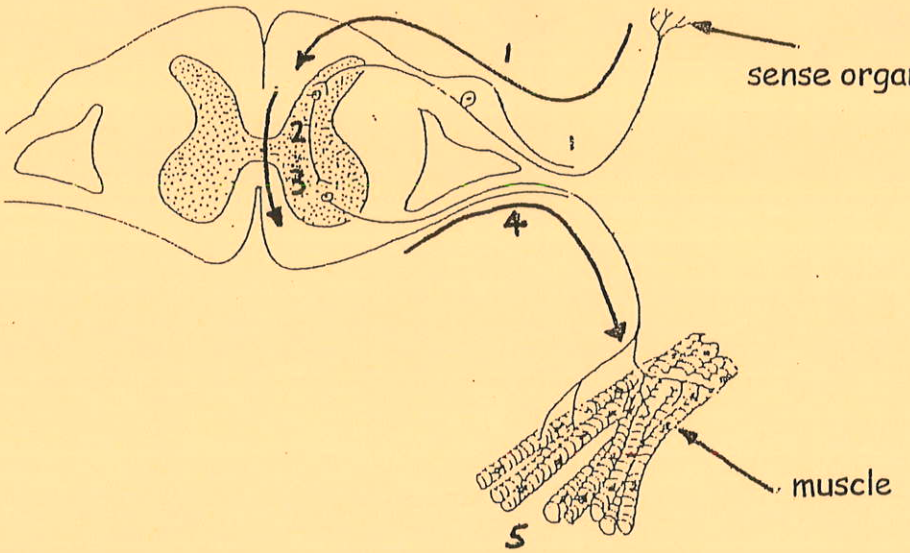
Credit

C14. What is binocular vision?
This is the ability to produce pictures in 3-dimensions. It allows us to judge distance.

C17. The semi circular canals are arranged at right angles to each other. Explain why this is important.
These detect head movements in all 3 planes.

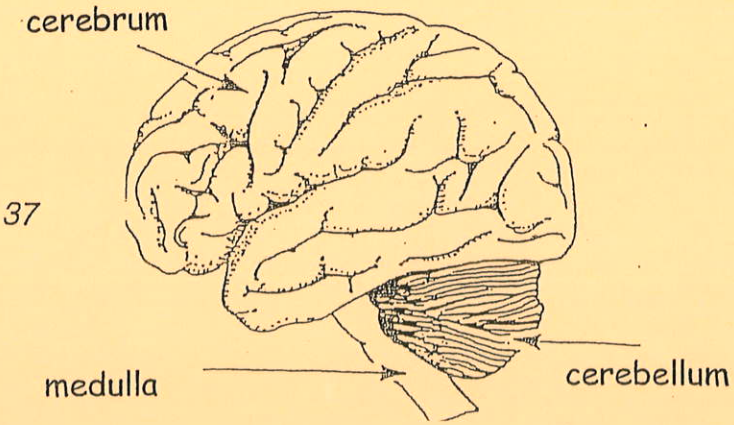


C19. Describe how a reflex action works.
This is an automatic response protecting the body from damage. It does not involve the brain.



1. *The receptor picks up the stimulus* and sends message along sensory neurone.
2. *The sensory neurone carries the impulse to the CNS and relay neurone.*
3. *The relay neurone passes the impulse to the motor neurone.*
4. *The motor neurone carries the impulse to the muscle.*
5. *The muscles contracts causing a response.*

C20. What is the function of the cerebellum, cerebrum and medulla in the brain.
Cerebellum - controls the muscles and balance.
Cerebrum - memory, reasoning, intelligence.
Medulla - controls heart rate and breathing.



Body in Action Subtopic d Changing levels of performance

General

G21. What causes muscle fatigue?
This is caused when we exercise and contract our muscles repeatedly.

G21. Why does muscle fatigue happen?
This is because there is a lack of oxygen in the muscles.

G22. Why does pulse rate and breathing rate increase during exercise?
Pulse rate increases to increase blood flow to carry more oxygen to the muscles.
Breathing rate increases to allow more oxygen into the lungs to diffuse into the blood.

G23. Compare the breathing rate, pulse rate and lactic acids levels in a trained person and an untrained person during exercise.
Pulse rate, breathing rate and lactic acids levels are lower in a trained person.

G23. What is meant by recovery time? How can this show fitness?
This is the time taken for the pulse rate, breathing rate and lactic acid levels to return to normal. A fit person will have a lower or quicker recovery time than an unfit person.

Credit

C23. What is the anaerobic respiration equation? Using this equation, explain muscle fatigue.
glucose ⟶ *lactic acid + a little energy.*
Muscle fatigue is when lactic acid builds up in the muscles and they get sore. There is not enough oxygen for the muscles to work and lactic acid builds up. When you stop exercising the lactic acids levels go down as there is now enough oxygen.

C23. Training improves which parts of the body?
Training improves the efficiency of the lungs and heart.

C24. What is the relationship between recovery time and training?
The more you train and exercise the quicker your recovery time will be.

Biotechnology Subtopic a Living factories

General

G1. Name two drinks and a food that depends on the activity of yeast.
Drinks - beer and wine.
Food - bread.

G2. How many cells does yeast contain? What does yeast use for energy?
Yeast are made of only one cell. They use glucose or sugar for food.

G3. What is the fermentation equation?

$$\text{sugar} \xrightarrow[\text{yeast}]{\text{Fermentation}} \text{alcohol} + \text{carbon dioxide} + \text{energy}$$

G6. The manufacture of cheese and yoghurt depend on which organism?
Bacteria.

G7. What causes milk to sour?
The fermentation of the sugar in the milk by bacteria.

Credit

C3. Compare aerobic and anaerobic respiration in yeast.

	Aerobic respiration	Anaerobic respiration
Oxygen needed	always	never
Amount of energy released	lots	very little
End products	carbon dioxide + water	carbon dioxide + alcohol

C4. How do commercial brewers provide the best growing conditions for yeast?
Optimum growth conditions for yeast are given. They are grown in huge fermenters which are set at the optimum temperature with the optimum concentration of sugar. The fermenters are sterilised to remove any unwanted micro-organisms.

C4. What is meant by batch processing?
This is when one batch is completed before another batch is placed in the vessels to grow.

C5. Why does barley have to be malted before it is used for an energy source for yeast?
Malting allows grains to germinate and converts starch into sugar so the yeast can use it as a food source. The yeast then respire anaerobically and produce alcohol.

C7. Write out the fermentation equation when bacteria use lactose sugar in milk as an energy source.

lactose —*fermentation*→ *lactic acid* (*causes souring*)

It is the lactic acid made by bacteria that causes milk to sour (drop in pH).

Biotechnology Subtopic b Problems with Profit and Waste

General

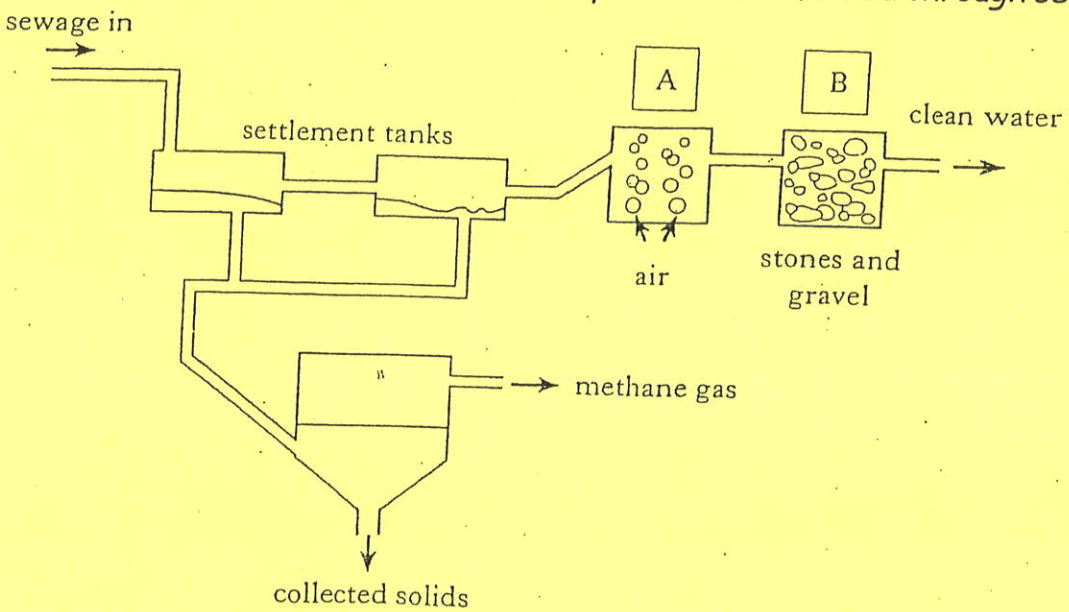
G8. Name two ways in which sewage will damage a river.
Bacteria build up and release minerals which allow water weeds to grow and clog up rivers. Bacteria use up oxygen which reduces the number of animal species.

G8. Give three diseases associated with dirty drinking water.
Dysentry, cholera and typhoid.

G9. Describe three precautions taken in a laboratory when using micro-organisms.
Lab coats must be worn, hands must be washed and culture bottles sealed to avoid contamination. Disinfectant must be used to kill micro-organisms.

G11. Why are micro-organisms important in sewage treatment?
They breakdown the sewage into harmless products.

G11. Describe how the oxygen required by the micro-organisms is provided during sewage treatment.
Oxygen is sprayed onto stone beds and compressed air is forced through sewage.



G12. Give two advantages of upgrading waste to useful products.
Saves money and does not pollute the environment.

G12. Give two examples of useful products made from waste.
Manure gas from cattle can be used as a fuel source.
Methanol from gas and oil can be used as a protein food source.
Whey from cheese making can be used as protein for cattle.

G13. Name 2 different products of fermentation.
Alcohol and methane gas.

G13. Give an advantage of getting fuel from fermentation rather than from fossil fuels.
Fossil fuels will run out - fermentation fuels will not. Fossil fuels pollute the air - fermentation fuels do not.

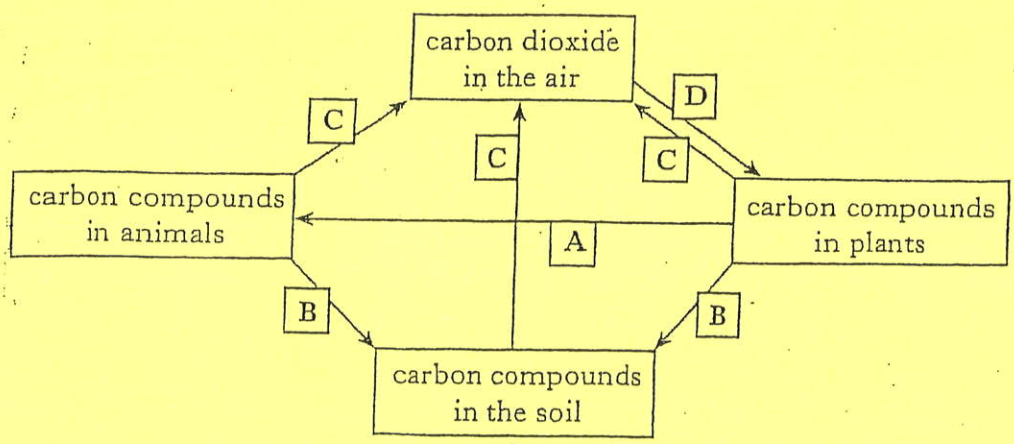
G14. When can micro-organisms reproduce?
Under suitable conditions (optimum temperature etc).

G14. Can micro-organisms be harvested for protein?
Yes they can be used for protein food for animals and humans.

Credit

C9. What is a resistant bacterial spore? What precautions are taken in the manufacturing process to get rid of any spores?
These are made by the microbes and allow them to survive extreme conditions.
All equipment is sterilised at high temperatures to get rid of any spores.

C10. Describe the part played by bacteria in the carbon and nitrogen cycle.
They breakdown animal and plant parts to release nitrogen and carbon back into the soil. The nitrogen cycle is shown in the Biosphere learning outcomes. Below is the carbon cycle.



A - Animal eats the plant to get protein.
B - Animal and plants die.
C- Plant, animal and microbial respiration.
D - Photosynthesis by plants.

C10. Explain the process of decay in terms of the energy requirements of micro-organisms.
Micro-organisms get energy from the sewage.

C11. Explain why complete breakdown of sewage occurs only in aerobic conditions.
Bacteria need aerobic conditions with oxygen to competely breakdown sewage into harmless substances like water and carbon dioxide. If bacteria are not given aerobic conditions the sewage is broken down into alcohol and carbon dioxide. The alcohol is a waste product.

C11. Explain why a range of micro-organisms is needed to breakdown sewage.
Sewage is a mixture of different things - food, chemicals, plastic or paper etc. One species of micro-organism cannot breakdown all these different things.

C12. Explain the advantages of upgrading waste in terms of protein levels.
These are renewable and never run out. Bacteria produce much more protein than any other organism.

Biotechnology Subtopic c Reprogramming microbes
General

G15. What does the normal control of bacterial activity depend on?
The chromosomal material.

G16. Can pieces of chromosome be transferred from one organism to another?
Yes. Chromosomes from one organism e.g human can be placed into another organism e.g bacteria.

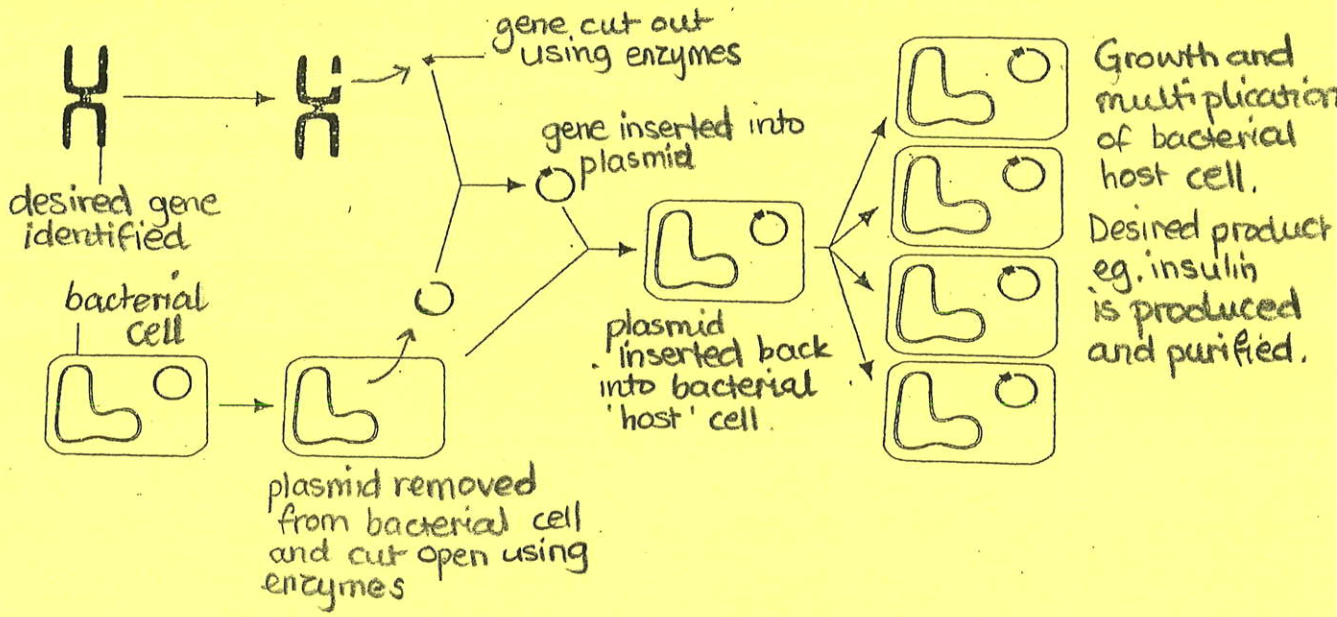
G18. Give some examples of the products of genetic engineering and where they are used.
Insulin - used to control sugar levels in diabetics.
Human growth hormone - used to increase bone length in humans.
Blood clotting factor - used to clot blood for people who are haemophiliacs.

G20. What do biological detergents contain?
Enzymes made by bacteria.

G22. What is an antibiotic?
It is a substance which stops the growth of bacteria.

Credit

C15. What is genetic engineering?
This is the manipulation of chromosomal material.



C16. Why is it an advantage to use bacteria in genetic engineering?
They produce large quantities of useful products very quickly.

C16. Give an advantage of genetic engineering compared with selective breeding in producing improved offspring.
Selective breeding takes a long time to improve characteristics (bred generation after generation). It may not give the improved characteristic at the end of the breeding programme.
Genetic engineering is quicker and there is a greater chance the improved characteristic is shown.

C18. Why do we need more and more insulin these days?
There are more diabetics who are living longer.

C20. Describe the advantages of using biological detergents.
They work at low temperatures and save energy (and money). Delicate clothing is less damaged by them. They digest difficult protein and fat stains.

Inheritance Subtopic a Variation

General

G1. What is a species?

This is a group of organisms that can interbreed and produce fertile offspring.

G2. Are all organisms in a species the same as each other?

No, there is variation in a species.

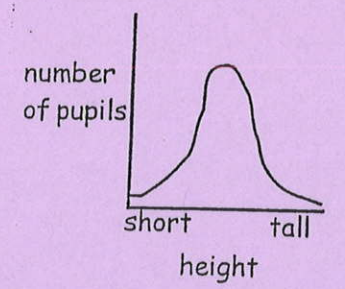
G3. Give two examples of continuous and discontinuous variation.

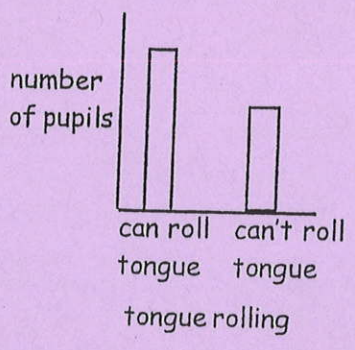
Continuous variation - weight, hand span, height, heart rate or bean seed mass.
Discontinuous variation - human fingerprint type, ability or inability to roll the tongue, attached or unattached ear lobes, human blood groups, white or red eyes in fruit fly, smooth or wrinkled seeds in pea plants.

Credit

1. What is meant by discontinuous and continuous variation.

Discontinuous variation - this is when a characteristic can divide members of a species into a few distinct groups e.g you can either roll your tongue or you cannot roll your tongue. A bar graph will show this with spaces between bars.
Continuous variation - this is when a characteristic shown varies in a smooth continuous way from one extreme to another e.g height in humans. A histogram with no spaces between the bars or a line graph will show this.





Inheritance Subtopic b What is inheritance?

General

G4. What part of a cell contains our genetic information? Where do we inherit our genetic characteristics from?

The nucleus contains our genetic information. It is inherted from our parents.

G5. Give examples of phenotypes of the same characteristic.

Eye colour - blue, brown, green or grey. Ear lobe type - attached or unattched.
Coat type in guinea pigs - smooth or rough.

G5. Know the following terms - true breeding, dominant, recessive, phenotype and genotype e.g B - Brown eyes and b - blue eyes.
True breeding - where both alleles are the same, either both dominant or both recessive (BB or bb). Eye colour brown or blue.
Dominant - this always shows in the phenotype (BB or Bb). All eyes are brown.
Recessive - this is masked by the dominant phenotype and will only show if both alleles are recessive (bb). Eye colour blue.
Phenotype - this is the appearance of an individual.
Genotype - a complete set of genes.

G6. Know P, F1 and F2 from genetic crosses.
P - parents, F1 - First generation and F2 - Second generation.

G6. Are all the F1 or first generation the same or uniform in a true breeding cross?
Yes.

G7. How many matching sets of chromosomes have each body cell?
2.

G7. What is a gamete?
This is a sex cell.

G7. How many sets of chromosomes do gametes have?
1. This is half the number of chromosomes compared to a normal body cell.

G7. Describe how a double set of chromosomes is achieved at fertilisation.
The set of chromosomes from the egg is added to the set of chromosomes from the sperm.

G8. A characteristic is controlled by 2 forms of a gene. Where do you get the two forms of a gene?
From your parents. Each gamete carried one of the two forms of the gene.

G8. What is a gene?
This is part of a chromosome.

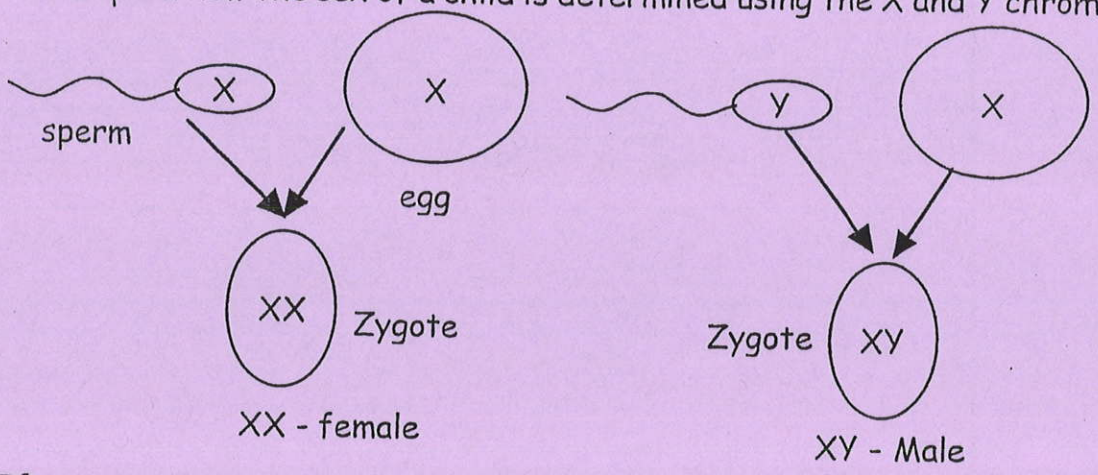
G8. What does the word genotype mean?
This is the set of genes that an organism has.

G9. The sex of a child is determined by which two chromosomes?
The X and Y chromsome.

G9. What two chromosomes do males have?
X and Y.

G9. What two chromosomes do females have?
Two X chromosomes.

G9. Explain how the sex of a child is determined using the X and Y chromosomes.



If a sperm carrying an X chromosome is fertilised with an egg carrying an X chromosome, then the zygote will be female (XX).
If a sperm carrying a Y chromosome is fertilised with an egg carrying an X chromosome, then the zygote will be male (XY).

Credit

C6. Are parents in a monohybrid cross normally true breeding?
Yes.

C8. What are two different forms of the same gene called?
Alleles.

C8. Explain differences between observed and predicted figures or ratios in a genetic cross.
Fertlisation is a random process and involves an element of chance.

Extra questions

C8. You should be able to complete a genetic cross. Below is an example of one. Black coat colour is dominant to brown coat colour in mice. Show the cross between a true breeding black mouse and a true breeding brown mouse.
B - Black coat.
b - brown coat.

P(parents)	phenotype - black coat genotype - BB gametes - all B	x	brown coat bb all b

F1 (first generation) all are Bb with black coats.

The F1 generation are self crossed.

phenotype - black coat genotype - Bb gametes - B or b	x	black coat Bb B or b

	B	b
B	BB	Bb
b	Bb	bb

F2 generation - BB, Bb, Bb and bb.
F2 phenotypes - 3 black coats and 1 brown coat.
F2 genotypes - 1 BB, 2 Bb and 1 bb.

Inheritance Subtopic c Genetics and Society

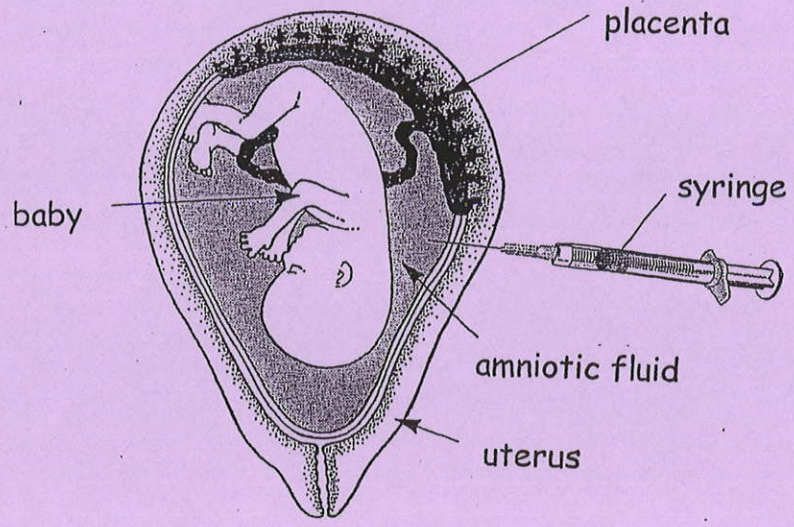
General

G10. Give two examples of an improved characteristic from selective breeding.
Increased yield - cattle are selectively bred to produce more milk.
Increased disease resistance in plants - more disease resistant potato.
Increased growth - cattle are bred to produce more beef.

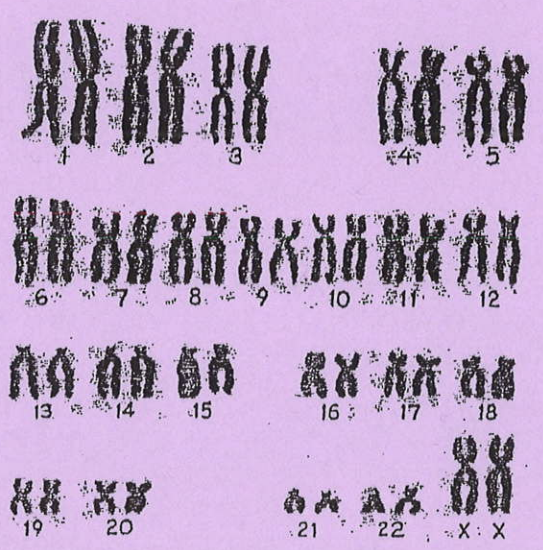
G11. Describe one example of a human condition caused by a chromosome change (mutation).
When a person has 47 chromosomes instead of 46, they have Down's Syndrome. The extra chromosome at number 21 gives the person a characteristic appearance and a reduced mental ability.

G12. What is amniocentesis?

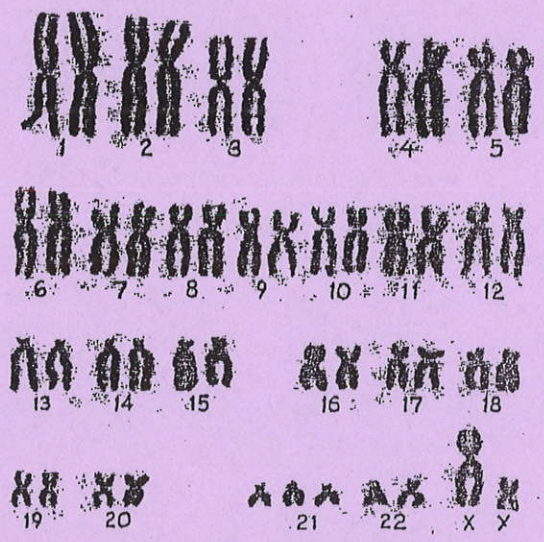
This is when a sample of cells from the amniotic fluid is taken using a syringe. This fluid contains some skin cells from the fetus which can be used study its chromosomes. Conditions like Down's Syndrome can be screened or the sex of a child can be determined.



The chromosomes can be arranged by those similar in size. An extra chromosome at set 21 shows Down's Syndrome. Two large chromosomes at set 23 show a female (XX) and one large and one small chromosome at set 23 show a male (XY).



Normal female



Downs Syndrome male

C12. Give an example of a charateristic which has been enhanced in plants and animals through selective breeding.

Maize plants - bred to produce more oil.

Poultry animals - grow more quickly and need half the amount of food.

Cattle - bred to produce more milk or beef .

C12. Give an example of a chromosome mutation which is an advantage to man.
Some plants have extra complete sets of chromosomes. Some wheat can produce more flour and some strawberries are extra large. Mutations make plants larger and increase yield.

C12. Give an example of a substance which causes mutations to occur.
UV Light, X-Rays and atomic radiation increase mutations.