IGCSE BIOLOGY 0610 · NIGHT-BEFORE SHEET · ~11 MIN READ

Biology Definitions & Key Facts

The syllabus definitions in exam wording, plus the equations, tests, processes and numbers that come up every year. Learn the definitions word for word.

Definitions | Cells | Food tests | Enzymes | Plants | Humans | Genetics | Ecology

AS
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No tag = **Core** (everyone) EXTENDED Extended only highlight = comes up again and again

HANDY worth memorising Test yourself at the end

IN 30 SECONDS

- **Definitions are marked word for word.** Learn the key words in each one. Missing one key word, such as "net" or "partially permeable", can lose the mark.
- **In "explain" questions link three things:** the feature, how it helps, and the result. For example: thin wall → short diffusion distance → faster gas exchange.
- **Equations, food-test colours and the genetics cross** are guaranteed topics. They are on this sheet.

1 Definitions to learn exactly

Characteristics of living things

MEMORY TRICK

MRS GREN: Movement, Respiration, Sensitivity, Growth, Reproduction, Excretion, Nutrition. These seven are what make something living.

Movement — an action by an organism or part of an organism causing a change of position or place.

Respiration — the chemical reactions in cells that break down nutrient molecules and release energy.

Sensitivity — the ability to detect and respond to changes in the environment.

Excretion — removal from organisms of toxic materials, the waste products of metabolism and substances in excess of requirements.

Movement in and out of cells

Diffusion — the net movement of particles from a region of higher concentration to a region of lower concentration, down a concentration gradient, as a result of their random movement.

Osmosis — the net movement of water molecules from a region of higher water potential to a region of lower water potential, through a partially permeable membrane.

Active transport — the movement of particles through a cell membrane from a region of lower concentration to a region of higher concentration, using energy from respiration.

- **Diffusion and osmosis are passive** (no energy from the cell). **Active transport needs energy** and works against the gradient.
- **A high surface area, a thin barrier and a steep gradient** all make diffusion faster.

Enzymes and nutrition

Enzyme — a protein that functions as a biological catalyst.

Catalyst — a substance that speeds up a chemical reaction and is not changed by the reaction.

Photosynthesis — the process by which plants manufacture carbohydrates from raw materials using energy from light.

Digestion — the breakdown of large insoluble molecules into small soluble molecules.

Absorption — movement of digested food molecules through the wall of the intestine into the blood.

Assimilation — movement of digested food molecules into the cells of the body where they are used, becoming part of the cells.

Egestion — passing out of food that has not been digested or absorbed, as faeces, through the anus.

- **Denaturing:** high temperature or the wrong pH changes the shape of the active site, so the substrate no longer fits. This is permanent.
- **Optimum:** each enzyme works fastest at one temperature and one pH. Body enzymes work best at about 37 °C.

Transport in plants and humans

Transpiration — the loss of water vapour from plant leaves by evaporation of water at the surfaces of the mesophyll cells, followed by diffusion of water vapour through the stomata.

Translocation — the movement of sucrose and amino acids in the phloem, from sources to sinks.

Homeostasis — the maintenance of a constant internal environment.

Hormone — a chemical substance produced by a gland and carried by the blood, which alters the activity of one or more specific target organs.

Reflex action — a means of automatically and rapidly integrating and coordinating stimuli with the responses of effectors.

Reproduction and inheritance

Gene — a length of DNA that codes for a protein.

Allele — a version of a gene.

Genotype — the genetic make-up of an organism in terms of the alleles present, for example Bb.

Phenotype — the observable features of an organism, for example brown eyes.

Dominant — an allele that is expressed if it is present. **Recessive:** an allele that is only expressed when no dominant allele is present.

Homozygous — having two identical alleles of a particular gene (BB or bb). **Heterozygous:** having two different alleles (Bb).

Mitosis — nuclear division giving rise to genetically identical cells, in which the chromosome number is maintained by the exact duplication of chromosomes.

Meiosis — nuclear division giving rise to cells that are genetically different, with half the chromosome number of the parent cell.

Sexual reproduction — the process involving the fusion of the nuclei of two gametes to form a zygote and the production of offspring that are genetically different from each other.

Asexual reproduction — the process resulting in the production of genetically identical offspring from one parent.

Natural selection — individuals with features that suit the environment are more likely to survive, reproduce and pass those features on to the next generation.

Ecology

Population — a group of organisms of one species, living in the same area at the same time.

Community — all of the populations of different species living in the same area.

Ecosystem — a unit containing the community of organisms and their environment, interacting together.

Habitat — the place where an organism lives.

Food chain — a diagram showing the transfer of energy from one organism to the next, beginning with a producer.

Pathogen — a disease-causing organism. **Drug:** a substance that modifies or affects chemical reactions in the body.

2 Tests, equations and processes

Food tests

Food tests: the colour change to learn

Starch iodine solution	**orange-brown → blue-black**
Reducing sugar Benedict's, heat in water bath	**blue → green → yellow → orange → brick-red**
Protein biuret reagent	**blue → purple (lilac)**
Fat ethanol, then add water	**clear → cloudy white emulsion**
Vitamin C DCPIP solution	**blue → colourless (vitamin C present)**

Learn the starting colour and the end colour of each test. Heat the Benedict's test in a water bath.

Equations

carbon dioxide + water → glucose + oxygen

photosynthesis (needs light and chlorophyll)

glucose + oxygen → carbon dioxide + water

aerobic respiration (releases energy)

glucose → lactic acid

anaerobic respiration in muscles

glucose → ethanol + carbon dioxide

anaerobic respiration in yeast (fermentation)

- **Symbol equations:** $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ for photosynthesis, and $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ for aerobic respiration.
- **Limiting factors of photosynthesis:** light intensity, carbon dioxide concentration and temperature. The factor in shortest supply limits the rate.

Digestion and the human body

- **Amylase** breaks down starch into maltose. **Protease** breaks down protein into amino acids. **Lipase** breaks down fats into fatty acids and glycerol.
- **Bile** is made in the liver, stored in the gall bladder, emulsifies fats (a larger surface area for lipase) and neutralises stomach acid.
- **The heart:** the right side pumps blood to the lungs and the left side pumps it to the body. The left ventricle has the thickest wall. Valves stop backflow.
- **Arteries** carry blood away from the heart at high pressure and have thick, elastic walls. **Veins** carry blood to the heart and have valves. **Capillaries** have walls one cell thick.
- **Blood:** red cells carry oxygen (haemoglobin), white cells fight infection (phagocytes and lymphocytes), platelets help clotting and plasma carries dissolved substances.
- **Breathing in:** the diaphragm contracts and flattens, the external intercostal muscles contract, the ribs move up and out, the volume of the chest increases, the pressure drops and air flows in.
- **Reflex arc:** stimulus → receptor → sensory neurone → relay neurone (in the spinal cord) → motor neurone → effector → response.
- **Negative feedback** reverses a change to bring a condition back to normal, for example insulin lowering blood glucose.

Plants

- **Xylem** carries water and mineral ions up from the roots. **Phloem** carries sucrose and amino acids. **Stomata** let carbon dioxide in and water vapour out.
- **Transpiration is faster** when it is hot, dry, windy or bright, because water evaporates and diffuses out more quickly.
- **Mineral ions:** nitrate is needed to make amino acids and proteins. Magnesium is needed to make chlorophyll.
- **Pollination** is the transfer of pollen from an anther to a stigma. **Fertilisation** is the fusion of the male and female nuclei.

3 Inheritance and numbers

Genetics

Bb × Bb

gametes	B	b
B	BB	Bb
b	Bb	bb

3 dominant : 1 recessive
25% BB · 50% Bb · 25% bb

Bb × bb

gametes	B	b
b	Bb	bb
b	Bb	bb

1 dominant : 1 recessive
50% Bb · 50% bb

dominant phenotype (shows B)

recessive phenotype (only bb)

Each parent gives one allele per gamete. Draw each gamete once. Cross the rows and columns to fill the square.

Write the parents' genotypes, split them into gametes, then fill the Punnett square. Read off the genotypes and the ratio.

- **Humans have 46 chromosomes** (23 pairs) in body cells and **23** in gametes. **XX** is female and **XY** is male, so each child has a 50% chance of being a boy.
- **Mutation** is a random change in a gene or chromosome. It can be caused by ionising radiation and some chemicals.
- **Variation:** continuous (a range, such as height) or discontinuous (distinct groups, such as blood group).
- **Natural selection steps:** variation exists → more offspring are born than survive → individuals with suited features survive and reproduce → they pass on the alleles.

Ecology and the environment

- **Energy** is lost between trophic levels as heat, movement and waste, so food chains are short and there is less biomass at each higher level.
- **Eutrophication:** fertiliser washes into water → algae grow quickly → they die and bacteria decompose them → oxygen in the water is used up → fish die.
- **Deforestation** reduces biodiversity, increases carbon dioxide in the air and can cause soil erosion and flooding.
- **The greenhouse effect:** carbon dioxide and methane trap heat, which causes global warming.

EXAM TIP

In "explain" questions link feature → how it helps → the result. For example, thin wall → short diffusion distance → faster gas exchange.

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4 Test yourself

Test yourself — cover the answers first

QUICK CHECK

1. What is the test for starch, and the positive result?
2. What colour change shows reducing sugar after heating with Benedict's reagent?
3. Give the colour change in the biuret test for protein.
4. Is osmosis the movement of water molecules or of solute particles?
5. What does amylase break starch down into?
6. Name the two types of vessel in a plant's transport system.
7. How many chromosomes are in a human gamete?
8. What is the phenotype ratio from Bb × Bb with B dominant?
9. What is the ratio of offspring from Bb × bb?
10. Write the word equation for aerobic respiration.
11. What is the difference between a gene and an allele?
12. Why does the left ventricle have the thickest wall?

EXAM-STYLE

13. Explain why a cell in concentrated sugar solution loses water. [3]
14. Describe how a root hair cell is adapted for absorbing mineral ions. [3]
15. Two heterozygous parents (Bb) have children. Show the genotypes of the children and the chance of a child with the recessive phenotype. [3]

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Show answers

1. iodine solution turns from orange-brown to blue-black
2. blue to green, yellow, orange or brick-red
3. blue to purple (lilac)
4. water molecules only, through a partially permeable membrane
5. maltose
6. xylem and phloem
7. 23
8. 3 dominant : 1 recessive
9. 1 Bb : 1 bb
10. glucose + oxygen → carbon dioxide + water
11. a gene is a length of DNA that codes for a protein, and an allele is a version of a gene
12. it pumps blood around the whole body, so it needs to generate high pressure
13. the solution outside has a lower water potential than the cell
    water moves out of the cell by osmosis
    through the partially permeable membrane
14. it has a large surface area because of the long hair-like extension
    it contains many mitochondria to release energy by respiration
    for active transport of mineral ions against the concentration gradient
15. gametes from each parent are B and b
    offspring are BB, Bb, Bb and bb
    the chance of a recessive child (bb) is 1 in 4, or 25%

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