Topic 2: Organisation

AQA GCSE Biology 8461 · spec 4.2 · sheets 2.1–2.4

Organisation: from cells to systems

- describe the levels of organisation from cells to organ systems;
- explain how enzymes digest food, and test foods for nutrients;
- describe the heart, blood vessels and blood, and how the lungs exchange gases;

Organisation: from cells to systems (2)

- explain **coronary heart disease** and evaluate its treatments, and interpret data about risk factors;
- describe plant tissues, **transpiration** and **translocation**.

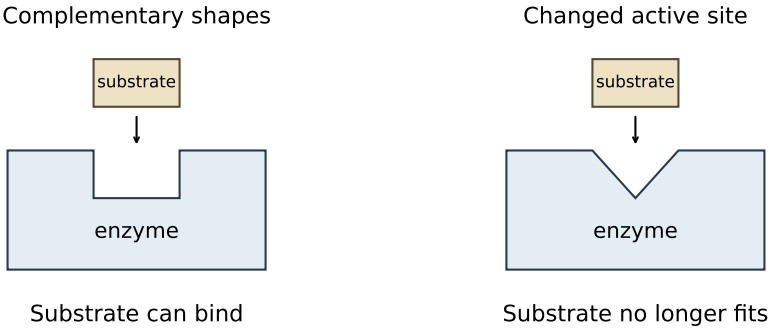
Levels of organisation

- a **tissue** is a group of cells with a similar structure and function, such as muscle **tissue**;
- an **organ** is a group of different tissues working together, such as the stomach;
- an **organ system** is a group of organs working together, such as the digestive system.

Enzymes and digestion

- it is alkaline, so it neutralises the hydrochloric acid from the stomach, giving the alkaline conditions that enzymes in the small intestine work best in;
- it **emulsifies** fat, breaking large drops into many small droplets. This gives a larger surface area for **lipase** to act on, so fat is digested faster.

Figure: Enzymes and digestion

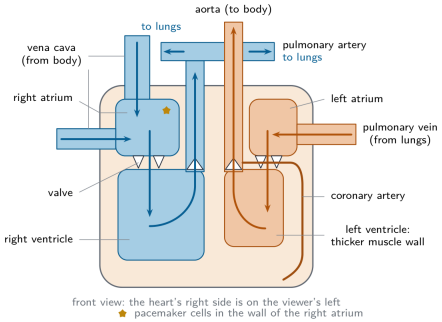


- Lock and key: the **substrate** fits the **active site**; after **denaturation** the changed active site no longer fits
- Match each part of the diagram to the text.

The heart and blood vessels

- **The heart** pumps blood around the body.
- Humans have a **double circulation** : blood passes through the heart twice on each complete circuit.
- The right side pumps blood to the lungs to pick up oxygen; the left side pumps it to the rest of the body.
- The route of blood through the heart:

Figure: The heart and blood vessels



- The heart seen from the front, so its right side is on the left of the page: blue for deoxygenated blood, red for oxygenated
- Match each part of the diagram to the text.

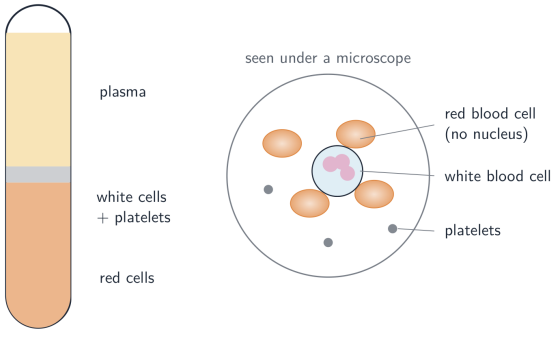
Blood

- **Plasma** is the pale yellow liquid. It carries dissolved glucose, amino acids, carbon dioxide, urea and hormones, and spreads heat around the body.
- **Red blood cells** carry oxygen. They contain **haemoglobin**, which joins with oxygen in the lungs; they have no nucleus, leaving more room for **haemoglobin**; and their shape, a disc pushed in on both sides, gives a large surface area.

Blood (2)

- **White blood cells** have a nucleus and defend the body: some engulf microorganisms and others make antibodies.
- **Platelets** are small pieces of cells that help blood to clot at a wound, stopping blood loss and keeping microorganisms out.

Figure: Blood



- The parts of blood: **plasma**, white cells and **platelets**, and red cells (not to scale)
- Match each part of the diagram to the text.

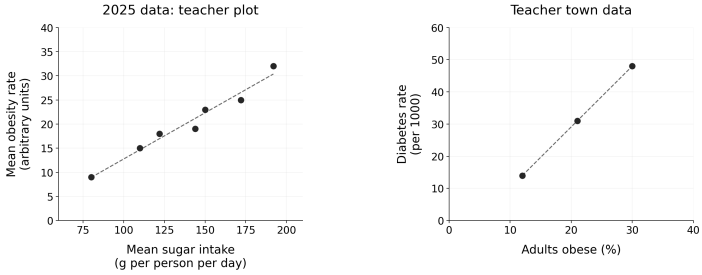
Coronary heart disease

- In **coronary heart disease** , layers of fatty material build up inside the **coronary arteries** and narrow them.
- Less blood reaches the heart muscle, so it gets less oxygen and glucose.
- Its cells release less energy by aerobic respiration, so the muscle cannot contract properly, which can cause chest pain and, if an artery becomes blocked, a heart attack.
- **Treatments.**

Health, risk factors and cancer

- A **benign tumour** grows in one place, usually inside a membrane, and does not invade other parts of the body.
- A **malignant tumour** invades nearby **tissue** and its cells can spread in the blood to form secondary tumours elsewhere.

Figure: Health, risk factors and cancer



- Left: sugar intake and obesity in seven countries (arbitrary units, AQA June 2025 data); right: obesity and diabetes rate in towns A, B and C; dashed lines are lines of best fit
- Read the axes and units first.

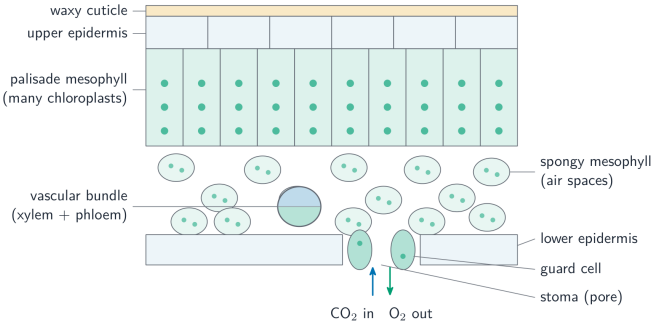
Plant tissues and organs

- The upper and lower **epidermis** cover the leaf; the upper **epidermis** has a **waxy cuticle** that reduces water loss.
- The **palisade mesophyll** has many chloroplasts, for photosynthesis.
- The **spongy mesophyll** has air spaces, so gases can diffuse through the leaf.

Plant tissues and organs (2)

- **Guard cells** open and close the **stomata**, the small pores that let carbon dioxide in and water vapour out.
- **Meristem** **tissue** at the tips of roots and shoots makes new cells for growth.

Figure: Plant tissues and organs

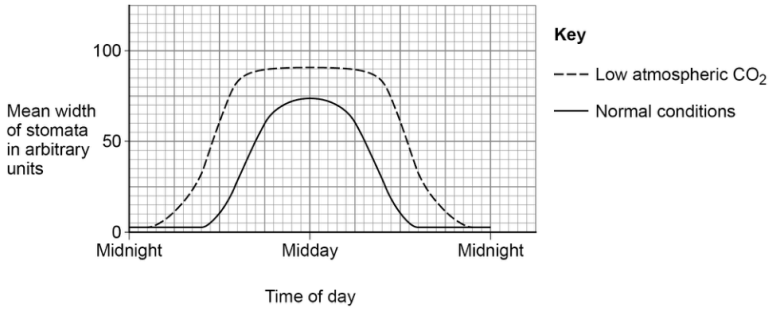


- A section through a leaf, not to scale; the dots in the palisade cells are chloroplasts
- Match each part of the diagram to the text.

Transpiration

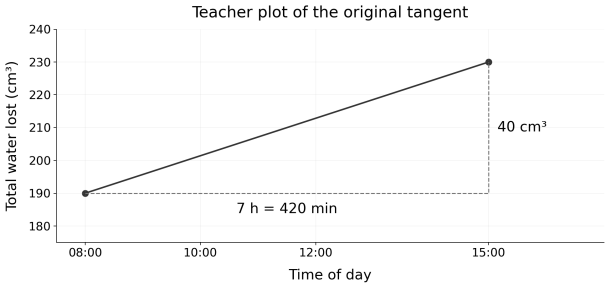
- **Transpiration** is the loss of water vapour from the leaves.
- Water evaporates from the surfaces of the mesophyll cells into the air spaces, and the vapour diffuses out through the **stomata**.
- As water is lost, more is pulled up the **xylem** from the roots: the **transpiration** stream.
- **Measuring transpiration.** A **potometer** measures how fast a leafy shoot takes up water, by timing how far an air bubble moves along a narrow tube.

Figure: Transpiration



- Mean width of **stomata** through the day (arbitrary units): solid line in normal air, dashed line in low carbon dioxide (AQA GCSE Biology Paper 1H, June 2022, Figure 7)
- Read the axes and units first.

Figure: Transpiration (2)



- The tangent at 12:00 passes through 190 cm^3 at 08:00 and 230 cm^3 at 15:00, so its gradient is 40 cm^3 in 7 hours
- Read the axes and units first.

Sources for this lesson

- AQA, *GCSE Biology (8461) specification*, section 4.2 Organisation, and the required practical handbook.
- C. N. Barnard, "The operation. A human cardiac transplant", *South African Medical Journal* 41 (30 December 1967), pages 1271 to 1274.
- AQA, *GCSE Biology* Paper 1 Higher (June 2021 to June 2025), the **amylase**, heart disease, **stomata** and **transpiration** questions, adapted.

Common errors

- Calling the stomach a **tissue**; it is an organ made of several tissues.
- Saying enzymes are "killed"; they are denatured.
- Saying **bile** is an **enzyme** or that it digests fat; it neutralises acid and emulsifies fat.

Common errors (2)

- Saying **arteries** carry oxygenated blood; they carry blood away from the heart.
- Writing that the **left ventricle** is thicker "because the body is further away"; it pumps at higher pressure.
- Saying a correlation proves cause.

Common errors (3)

- Mixing up benign and malignant tumours.
- Saying **xylem** carries sugar or that **phloem** carries water.
- Saying **transpiration** increases in humid air.

Key terms

- **Enzyme**: a protein that speeds up a reaction without being used up.
- **Active site**: the part of an **enzyme** that the **substrate** fits into.
- **Denaturation**: a permanent change in the shape of an enzyme's **active site**.

Key terms (2)

- **Double circulation**: blood passes through the heart twice in each complete circuit.
- **Coronary heart disease**: narrowing of the **coronary arteries** by fatty material.
- **Risk factor**: something linked to a higher chance of getting a disease.

Key terms (3)

- **Malignant tumour**: a tumour that invades tissues and spreads to form secondary tumours.
- **Transpiration**: the loss of water vapour from a plant's leaves.
- **Translocation**: the movement of dissolved sugars through the **phloem**.

Check yourself

- 1.
- Name the **enzyme** that digests protein, and the products. 2.
- Give the two functions of **bile**. 3.
- Describe the test for starch and the positive result. 4.