

Homeostasis and temperature control

Revision notes · Why the body keeps its internal environment constant, and how the skin and brain control body temperature.

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Homeostasis and temperature control **Spec 7.9–7.12B**

Maintaining a constant internal environment **Spec 7.9**

Homeostasis Maintaining a constant internal environment in response to internal and external change.

Conditions inside the body change. Eating a meal changes blood glucose. Exercise raises body temperature. A hot or cold day changes the temperature outside. The body responds to keep the conditions inside **constant**.

Conditions the body keeps constant

Condition	Example of a change
Blood glucose concentration	A meal raises it, exercise lowers it
Body temperature	Hot or cold surroundings, or exercise
Water content of the blood	Sweating, or drinking a lot

This matters because **enzymes and cells work best in a narrow range of conditions**. If conditions drift too far, reactions in cells slow down or stop. Many of these controls use negative feedback.

Exam tip: Constant does not mean the level never changes. It means the body brings it back to a set level, so say 'kept within narrow limits'.

Thermoregulation and osmoregulation **Spec 7.10B** **Triple only**

Thermoregulation: the effect on enzyme activity

Thermoregulation is the control of body temperature. Core body temperature is kept at about 37°C, which is the **optimum temperature** for most enzymes in the body.

- If the temperature rises too far, enzymes are **denatured**. The shape of the active site changes, so the substrate no longer fits and the reaction stops.
- If the temperature falls too far, enzymes work more slowly, so reactions in cells are too slow.

Osmoregulation: the effect on animal cells

Osmoregulation is the control of the water content of the blood. Animal cells have no cell wall, so water moving by **osmosis** changes them.

Blood water content	Effect on animal cells
Too high (blood too dilute)	Water enters the cells by osmosis. The cells swell and may burst
Too low (blood too concentrated)	Water leaves the cells by osmosis. The cells shrink

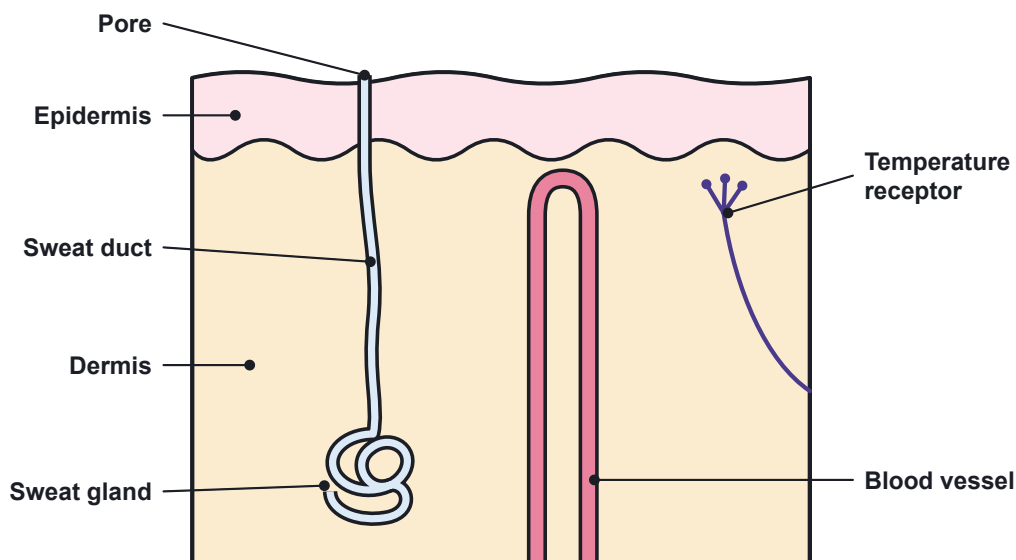
Common mistake: Say enzymes are denatured, not 'killed'. Enzymes are proteins, not living things.

The skin and the hypothalamus Spec 7.11B Triple only

The skin has two main layers, the **epidermis** and the **dermis**. The **hypothalamus** in the brain is the control centre for temperature.

Part	Role in thermoregulation
Epidermis	The thin outer layer of the skin. Sweat reaches the skin surface through pores in the epidermis, and heat is lost from the surface
Dermis	The layer below the epidermis. It contains the sweat glands, blood vessels that supply the skin, and temperature receptors that detect changes in skin temperature
Hypothalamus	Monitors the temperature of the blood and receives impulses from temperature receptors in the skin. It coordinates the response by sending nerve impulses to the effectors, such as the sweat glands, muscles and blood vessels

Exam tip: Link each part to a job. Say what the hypothalamus detects and what it then triggers, not just that it 'controls' temperature.



The structures in the skin involved in **thermoregulation**.

Responses to heat and cold Spec 7.12B Triple only

When the body is too hot

- Sweat glands release **sweat** onto the skin. Sweat evaporates and takes heat from the skin, which cools the body.

Higher tier

- Vasodilation**: the blood vessels supplying the skin surface widen. More blood flows near the surface, so more heat is lost to the surroundings.

When the body is too cold

- Shivering**: muscles contract rapidly. This needs more respiration in the muscle cells, which transfers energy as heat and warms the body.

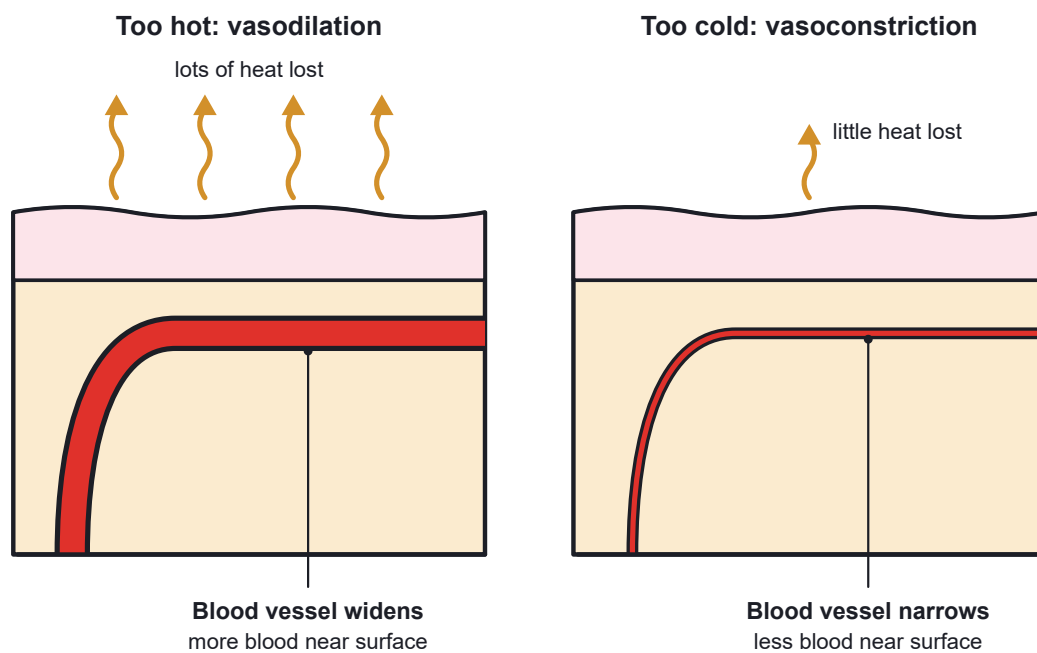
Higher tier

- **Vasoconstriction**: the blood vessels supplying the skin surface narrow. Less blood flows near the surface, so less heat is lost.
- Sweating is reduced when the body is cold.

Higher tier

Common mistake: Blood vessels do not move up or down in the skin. They get wider (vasodilation) or narrower (vasoconstriction).

Higher tier



Vasodilation brings more blood near the surface to lose heat; **vasoconstriction** reduces heat loss.

Quick check

1. Define homeostasis.
2. Why does a high body temperature stop reactions in cells? (Triple only)
3. What happens to animal cells if the blood is too dilute? (Triple only)
4. Which part of the brain coordinates temperature control? (Triple only)
5. How does shivering warm the body? (Triple only)

Quick check answers

Homeostasis and temperature control

1. Maintaining a constant internal environment in response to internal and external change.
2. Enzymes are denatured, so substrates no longer fit the active site.
3. Water enters by osmosis. The cells swell and may burst.
4. The hypothalamus.
5. Muscles contract rapidly. Respiration in the muscle cells transfers energy as heat.