Homeostasis

4.5.1 · Homeostasis and response · revision notes

Homeostasis is how your body keeps its internal conditions steady so that cells and enzymes can work properly. It comes up as short definition questions and as 'name the part of the control system' questions, and it is the basis for every other subtopic in Homeostasis and response.

Key facts

- Homeostasis = regulation of internal conditions to maintain optimum conditions for function
- Why it matters: optimum conditions for enzyme action and all cell functions
- Coordination centre (brain, spinal cord, pancreas) = receives and processes information
- Stimulus → receptor → coordination centre → effector → response
- Controlled in humans: blood glucose concentration, body temperature, water levels
- Receptor = cell that detects a stimulus
- Effector = muscle or gland that brings about a response
- Control can be nervous, hormonal (chemical) or both

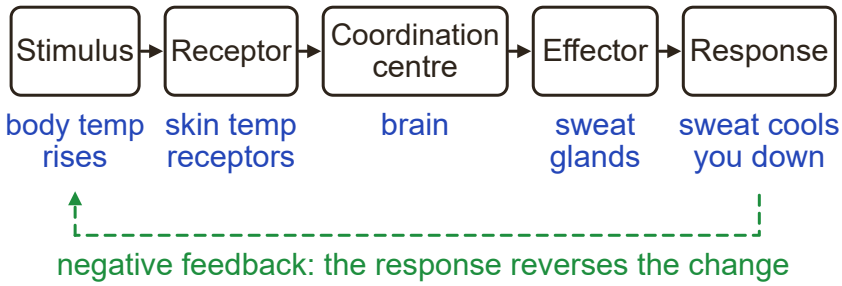
Notes

What homeostasis is

- **Homeostasis** is the regulation of the **internal conditions** of a cell or organism to maintain **optimum conditions** for function, in response to internal and external changes.
- It matters because **enzymes** and all **cell functions** work best in particular conditions. If conditions move too far from the optimum, reactions slow down and cells can be damaged (for example, a high temperature denatures enzymes).
- In the human body, homeostasis controls **blood glucose concentration**, **body temperature** and **water levels**.
- The control is **automatic**: you do not have to think about it. It can involve **nervous** responses, **chemical (hormonal)** responses, or both.

The parts of every control system

- **Receptors** are cells that detect **stimuli** (changes in the internal or external environment).
- **Coordination centres**, such as the **brain**, the **spinal cord** and the **pancreas**, receive and process information from receptors.
- **Effectors** are **muscles or glands**. They bring about responses that restore optimum levels.
- Muscles respond by **contracting**; glands respond by **secreting** (releasing) substances such as hormones.
- The sequence is always: **stimulus** → **receptor** → **coordination centre** → **effector** → **response**.



Every control system: stimulus → receptor → coordination centre → effector → response (example in blue).

An example

- On a hot day, temperature receptors in your skin detect the rise in temperature (stimulus and receptor).
- Your brain processes the information (coordination centre).
- Your sweat glands release more sweat (effector), which cools you down (response).
- Most homeostatic systems work by **negative feedback**: if a level rises, the response brings it down; if it falls, the response brings it back up. Grade 6+ only

How to answer each type of question

Define homeostasis 1 to 2 marks **Grade 4**

1. Use the key words: regulation (or maintaining), internal conditions, optimum.
2. For a second mark, add 'in response to internal and external changes' or say what the optimum conditions are for (enzymes and cell functions).

Example. What is meant by the term homeostasis?

Model answer. Regulating / keeping the internal conditions of the body steady (1) at the optimum for enzymes and cells to function, despite internal and external changes (1).

Identify the receptor, coordination centre or effector

1 mark each | Grade 5

1. Receptors detect: find the cells that sense the change.
2. Coordination centres process: the brain, spinal cord or pancreas.
3. Effectors respond: a muscle that contracts or a gland that secretes.

Example. A person walks from a warm room out into the snow and starts to shiver.
(a) Name the type of cell in the skin that detects the fall in temperature.
(b) Name the coordination centre that processes this information.
(c) Shivering happens when muscles contract. What part of the control system is a muscle?

Model answer.

(a) Receptor (cells) / temperature receptors (1)
(b) The brain (1)
(c) An effector (1)

Explain why homeostasis is important

2 marks | Grade 5

1. Link the condition to enzymes or cell functions.
2. Say what goes wrong if the condition is not controlled, using the context in the question.

Example. Explain why it is important that human body temperature is kept close to 37 °C.

Model answer. 37 °C is the optimum temperature for the enzymes in the body (1). If the temperature rises too far, enzymes are denatured / if it falls, reactions become too slow, so cells cannot function properly (1).

Don’t lose marks

- Leaving out 'internal'. Homeostasis controls conditions inside the body, not the surroundings.
- Saying receptors 'detect the stimulus and respond'. Receptors only detect; effectors respond.
- Calling the brain an effector or a muscle a receptor. Learn which part does which job.
- Writing that enzymes are 'killed' when it is too hot. Enzymes are not alive: they are denatured.

More tips

Memory tricks

- 'Homeo' means 'same' and 'stasis' means 'staying still': homeostasis keeps things the same.
- Learn the chain as SRCER: Stimulus, Receptor, Coordination centre, Effector, Response.
- Effectors are only ever muscles or glands. If it is not one of those, it is not an effector.
- The three things your body keeps steady: sugar (glucose), heat (temperature) and water.

Exam technique

- Learn the definition closely: examiners look for 'internal conditions' and 'optimum'.
- In a new context, work through stimulus, receptor, coordination centre, effector and response in order and label each one.
- When asked why homeostasis matters, always mention enzymes or cell functions.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Define homeostasis**
Regulating the internal conditions of a cell or organism to keep them at the optimum, in response to internal and external changes.

Grade 3 — **Name conditions controlled by homeostasis**
In humans: blood glucose concentration, body temperature and water levels.

Grade 4 — **Name the three parts of a control system**
Receptors, coordination centres and effectors.

Grade 5 — **Explain why homeostasis is important**
It keeps conditions at the optimum for enzyme action and all cell functions.

Grade 5 — **Describe the job of each part**
Receptors detect stimuli, coordination centres process the information, and effectors (muscles or glands) bring about a response.

Grade 5 — **Apply the control system to new contexts**
Pick out the stimulus, receptor, coordination centre, effector and response in an unfamiliar example.

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