20.1 Feedback and internal conditions

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

KEY WORDS homeostasis • negative feedback

Objective

Feedback and internal conditions. Original classroom practice for IB SL; not an official IB paper.

1 Key knowledge and worked examples

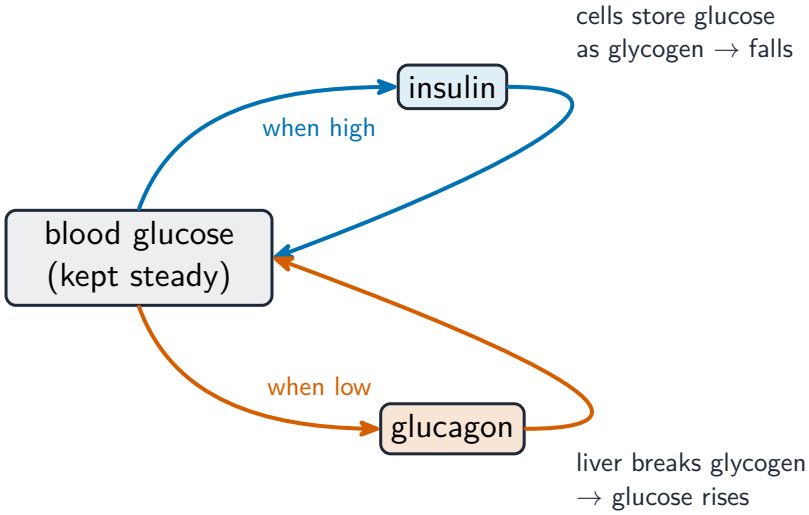
What would explain this observation?

- Blood glucose rises after a meal, but usually does not keep rising indefinitely. A control system responds to the change in internal conditions.

Build the model

- **Homeostasis** maintains internal conditions within suitable limits.
- Receptors detect changes, coordination centres process information, and effectors respond.
- **Negative feedback** opposes the original change.
- homeostasis: Maintenance of suitable internal conditions.
- negative feedback: A response opposing the original change.

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Choose evidence that can test it

- When blood glucose is high, insulin helps increase glucose uptake and storage as glycogen.
- When it is low, glucagon supports release of glucose from stores.
- These responses are coordinated, not identical effects of two hormones.

In the lab: Interpret a time graph by identifying the initial disturbance, the response and the return toward the normal range. Mark the delay before a response. Do not assume a graph shows an instantaneous correction.

Work from known quantities

- Known: glucose changes from 5.0 to 7.0 arbitrary concentration units.
- Increase = final - initial.
- Increase = 7.0 - 5.0 = 2.0 units.
- Percentage increase = $2.0/5.0 \times 100 = 40\%$.
- The numerical change is evidence of a disturbance, not a diagnosis on its own.

Your turn: A value rises from 4.0 to 5.0. Calculate the percentage increase.

Check the conclusion and its limits

- Negative feedback does not mean the response is harmful or the measured value becomes negative.
- Diabetes has different mechanisms; do not treat every case as a failure to make insulin.

Not true: Negative feedback always makes the measured value negative. Negative feedback means the response opposes the change - it pushes the value back towards the set point. "Negative" describes the direction of correction, not a harmful effect or a negative measurement.

Key:

- Homeostasis maintains internal conditions within suitable limits.
- When blood glucose is high, insulin helps increase glucose uptake and storage as glycogen.
- Watch for: negative feedback does not mean the response is harmful or the measured value becomes negative.

■ **Write from a rise of 30 percent**

- A value rises from 5.0 to 6.5.
- Find the percentage increase. Negative feedback opposes the change. It does not make the value negative.

2 Practice

2.1 Which response opposes a rise in blood glucose? Choose one answer.

- **A** Increased release of glucose from glycogen
- **B** Increased insulin action
- **C** Stopping all cellular respiration [1]

2.2 A value rises from 4.0 to 5.0. Calculate the percentage increase. Show the relation, substitution and units. [2]

2.3 Decide whether this claim is true and justify: Negative feedback means the response opposes the change - it pushes the value back towards the set point. “Negative” describes the direction of correction, not a harmful effect or a negative measurement. [2]

2.4 Maintenance of suitable internal conditions: write the technical term. [1]

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3 Exam-style questions

3.1 A fictional regulated variable changes from 4 to 5 units, then returns to 4. Explain the sign of the corrective response and why recovery alone does not identify the sensor. [4]

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Solutions

2.1 B Insulin lowers blood glucose by promoting uptake and storage of glucose, opposing the rise - this is negative feedback. Releasing glucose from glycogen would raise glucose further, and stopping respiration would harm cells rather than regulate glucose.

2.2 percentage increase=$(5.0-4.0)/4.0\times100=25\%$.

2.3 True. True. Negative feedback means the response opposes the change - it pushes the value back towards the set point. “Negative” describes the direction of correction, not a harmful effect or a negative measurement.

2.4 homeostasis. homeostasis means Maintenance of suitable internal conditions.

3.1 The disturbance is +25%. A negative-feedback response opposes it. Recovery is consistent with regulation but cannot by itself identify sensor, signalling pathway or rule out another cause.