

Exercise walk-through

20.1

Feedback and internal conditions

International Baccalaureate · IB Diploma · Biology · SL

20.1 Feedback and internal conditions

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

KEY WORDS homeostasis • negative feedback

Objective

Feedback and internal conditions. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

1 Key knowledge and worked examples

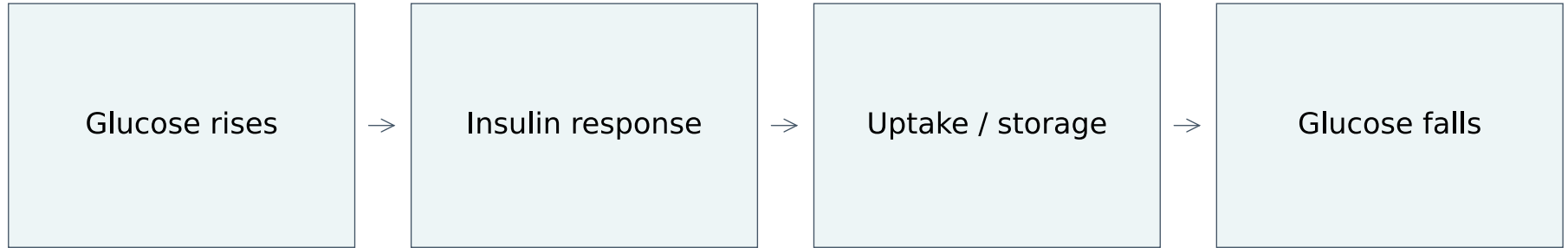
■ What would explain this observation?

- Blood glucose rises after a meal, but usually does not keep rising indefinitely. A control system responds to the change in internal conditions.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ 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.



■ 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.
- 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

- State the known values and their units. Choose the relation because its assumptions

fit this case, then rearrange before substitution.

- 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.

Example:

A value rises from 4.0 to 5.0. Calculate the percentage increase. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ 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.

- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Negative feedback always makes the measured value negative. This claim is false: 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.

Key:

Feedback and internal conditions: 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.

Exercises 2.1·2.3

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

- **A** Increased insulin action
- **B** Increased release of glucose from glycogen
- **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 always makes the measured value negative.

[2]

Exercises 2.1-2.3

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

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

[1]

2.1 A 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.

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

[2]

2.2 percentage increase = $(5.0 - 4.0) / 4.0 \times 100 = 25\%$.

2.3 Decide whether this claim is true and justify: Negative feedback always makes the measured value negative.

[2]

2.3 False. 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.

Exercises 2.4·3.1

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

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]

Exercises 2.4·3.1

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

3 Exam-style questions

2.4 homeostasis. homeostasis means Maintenance of suitable internal conditions.

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]

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.