

2.1 Hydration: interpret balance without forcing dehydration

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS water balance • sweat rate

Objective

Hydration: interpret balance without forcing dehydration. Supported HL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

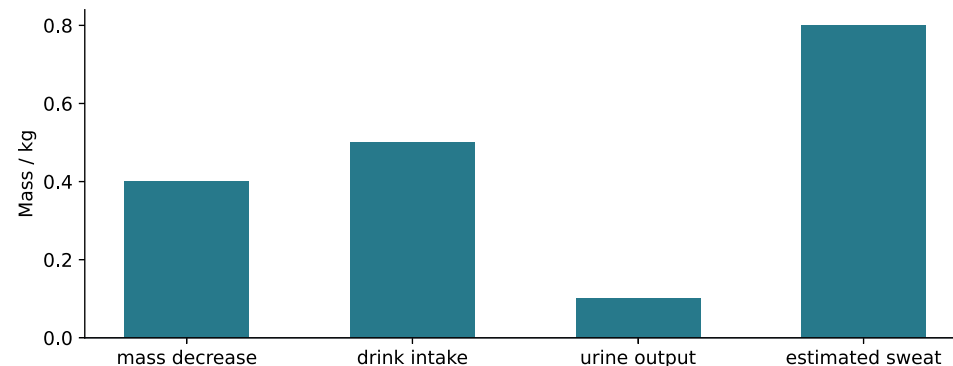
1 Key knowledge and worked examples

■ What would explain this observation?

- Body mass can change during activity, but the change is not a direct measurement of sweat alone. Drinking, urine, clothing and scale uncertainty affect the estimate.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- **Water balance** compares inputs and outputs. During exercise, heat production can increase sweating, while thirst and hormonal regulation contribute to fluid balance. Hydration needs vary with activity, environment and the person; a classroom calculation cannot prescribe a universal intake or diagnose a health condition.
- water balance: Relationship between water inputs, outputs and storage; **sweat rate** : Sweat volume lost per unit time under stated conditions.



■ Choose evidence that can test it

- For a simplified field estimate, sweat loss in kilograms is approximately pre-activity mass minus post-activity mass plus drink mass minus urine mass. Express the estimate per hour only after recording duration. This approximation omits some respiratory and metabolic mass changes and assumes comparable dry clothing and a suitable balance.
- Analyse fictional or consented teacher-approved low-risk data. Record balance resolution, time, intake and whether clothing conditions match. Students need not exercise or disclose personal body mass. Never restrict drinking or induce dehydration to create a result. Compare uncertainties and alternative explanations before interpreting a difference.

■ 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: fictional mass is 60.0 kg before and 59.6 kg after one hour; drink intake is 0.50 kg and urine output 0.10 kg. Estimated sweat loss = $60.0 - 59.6 + 0.50 - 0.10 = 0.80$ kg, approximately 0.80 L using 1 kg/L. The 0.40 kg body-mass decrease alone would underestimate this modelled loss.

Example:

Fictional mass changes from 70.0 to 69.7 kg, with 0.40 kg drink and 0.10 kg urine in one hour. Estimate sweat loss. Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

■ Check the conclusion and its limits

- A change in mass is not necessarily a change in body fat. A modelled sweat estimate does not justify fluid restriction, diagnosis, or a one-size-fits-all sports recommendation.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

Body-mass change during an activity directly measures sweat loss without other information. This claim is false: A change in mass is not necessarily a change in body fat. A modelled sweat estimate does not justify fluid restriction, diagnosis, or a one-size-fits-all sports recommendation.

Key:

Hydration: interpret balance without forcing dehydration: For a simplified field estimate, sweat loss in kilograms is approximately pre-activity mass minus post-activity mass plus drink mass minus urine mass. Express the estimate per hour only after recording duration. This approximation omits some respiratory and metabolic mass changes and assumes comparable dry clothing and a suitable balance.

2 Practice

2.1 Which quantity is required in addition to before/after mass in this model? Choose one answer.

- **A** Recorded fluid intake and urine output
- **B** Only the athlete's favourite sport
- **C** A forced period without drinking

[1]

2.2 Fictional mass changes from 70.0 to 69.7 kg, with 0.40 kg drink and 0.10 kg urine in one hour. Estimate sweat loss. Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: Body-mass change during an activity directly measures sweat loss without other information.

[2]

2.4 Relationship between water inputs, outputs and storage: write the technical term.[1]

3 Exam-style questions

3.1 Fictional mass falls 0.4 kg with 0.5 kg drink and 0.1 kg urine. Find modelled sweat loss and explain why this is not a drinking prescription.

[4]