

Ben's Bad Day

Regulating Temperature, Water Balance & Blood Glucose Level

Ben cannot catch a break. For each situation below, work out the negative-feedback loop his body uses to fight back. Fill in the stimulus, receptor, control centre, effector, and response.

Key Terms

Term	What it means
Stimulus	A change in the internal or external environment that pushes a variable away from its normal set point.
Receptor	A cell, tissue, or organ that detects the stimulus and converts it into a signal — a nerve impulse or a hormone.
Control Centre	The part of the body that receives the signal, compares it against the set point, and decides what response is needed.
Effector	A muscle or gland that carries out the control centre's instructions.
Response	The change the effector produces, which counteracts the original stimulus and restores the set point.

7:30 AM • Breakfast Drink

Ben gulps down a big glass of milk and a whole bottle of water at breakfast, trying to wake himself up. Soon after, he's dashing to the bathroom every few minutes.

Step	Your answer
Stimulus	
Receptor	
Control Centre	
Effector	
Response	

8:30 AM • Cold Walk to Lab

Ben steps outside into a cold morning without a jacket, rushing to school. Within a minute his teeth are chattering and his arms are covered in goosebumps.

Step	Your answer
Stimulus	
Receptor	
Control Centre	
Effector	
Response	

1:00 PM • No Time for Lunch

Ben's been so busy all morning he skips lunch entirely. By 1:00 PM his blood glucose has dropped low, and he's starting to feel shaky and lightheaded.

Step	Your answer
Stimulus	

Step	Your answer
Receptor	
Control Centre	
Effector	
Response	

3:00 PM • Hot Afternoon

The afternoon sun is blazing and Ben's classroom fan is broken. Within minutes he's sweating through his shirt and his face is flushed red.

Step	Your answer
Stimulus	
Receptor	
Control Centre	
Effector	
Response	

9:30 PM • Forgot to Drink Water

Ben's been so busy he hasn't had a sip of water since lunch. By night time, his mouth is bone dry and his blood is far more concentrated than it should be.

Step	Your answer
Stimulus	
Receptor	
Control Centre	
Effector	

Step	Your answer
Response	

Check Your Understanding

True or False? Circle your answer for each statement.

1. A response is the body's way of correcting an imbalance.

True / False

2. Drinking too much water at breakfast causes Ben's blood osmolarity to rise.

True / False

3. Shivering is an effector response controlled by the thermoregulatory centre in the hypothalamus.

True / False

4. Sweating and dilation of skin blood vessels help cool Ben down on a hot afternoon.

True / False

5. When Ben is dehydrated, the pituitary gland releases ADH to make the kidneys produce more urine.

True / False

6. In Ben's No Time for Lunch scenario, insulin is released to raise his blood glucose level.

True / False

7. The hypothalamus acts as the control centre in both the Breakfast Drink and Hot Afternoon scenarios.

True / False

8. All five of Ben's homeostatic responses in this activity are examples of negative feedback.

True / False

Multiple Choice Questions

Circle the letter of the best answer for each question.

1. Which correctly orders the components of a negative feedback loop?
 - A. Stimulus → Effector → Receptor → Control Centre → Response
 - B. Stimulus → Receptor → Control Centre → Effector → Response
 - C. Receptor → Stimulus → Effector → Control Centre → Response
 - D. Control Centre → Stimulus → Receptor → Effector → Response

2. In Ben's Breakfast Drink scenario, what happens after he drinks too much milk and water?
 - A. Blood osmolarity rises, so more ADH is released
 - B. Blood osmolarity falls, so less ADH is released and more dilute urine is produced
 - C. Blood glucose rises, so insulin is released
 - D. The kidneys reabsorb more water to concentrate the blood

3. Which pair of effector responses helps Ben cool down during the Hot Afternoon scenario?
 - A. Shivering and vasoconstriction of skin blood vessels
 - B. Sweating and vasodilation of skin blood vessels
 - C. Increased breathing rate and heart rate
 - D. ADH release and reduced urine output

4. In Ben's No Time for Lunch scenario, what does glucagon cause the liver to do?
 - A. Store excess glucose as glycogen
 - B. Break down glycogen and release glucose into the blood
 - C. Produce insulin to lower blood glucose
 - D. Absorb water to dilute the blood

5. In the Forgot to Drink Water scenario, what does ADH do once released?
 - A. Increases urine production to flush out excess water
 - B. Makes the kidneys reabsorb more water, producing more concentrated urine
 - C. Signals the pancreas to release more insulin
 - D. Widens skin blood vessels to release more heat