Homeostasis and Feedback Practice

Use this key to check answers and read the explanations.

1. As a person moves between cooler and warmer rooms, their internal temperature changes slightly but stays within a narrow range. Which idea does this illustrate?

A. Homeostasis allows small fluctuations within a stable range.
B. Homeostasis keeps every internal measurement exactly constant.
C. The body’s internal temperature must match the room temperature.
D. Any temperature change means a feedback loop has stopped working.

Correct answer: A. Homeostasis allows small fluctuations within a stable range.
Homeostasis keeps internal conditions within limits. A regulated value can rise or fall slightly while remaining in its usual range.

2. When the body increases sweating after warming up, which quantity is the temperature feedback loop regulating?

A. The temperature of the surrounding air
B. The amount of sweat released
C. Core body temperature
D. The amount of heat carried away by evaporation

Correct answer: C. Core body temperature
Core body temperature is the quantity the loop works to keep within its usual range. Sweat output and evaporation can change as part of the response.

3. Specialized nerve endings in the skin send signals that vary when skin temperature changes. What role do those nerve endings play in temperature regulation?

A. Control center
B. Sensor
C. Effector
D. Set point

Correct answer: B. Sensor
A sensor detects a condition and sends information about it. These nerve endings provide information about the skin’s temperature.

4. Which structure carries out the response that puts sweat onto the skin when the body warms?

A. Blood vessels in the skin
B. Skin temperature sensors
C. The brain’s temperature control center
D. Sweat glands

Correct answer: D. Sweat glands
Sweat glands are the effectors for sweating. The water they release can evaporate from the skin and carry heat away.

5. What makes a response an example of negative feedback?

A. It always lowers the regulated value.
B. It acts against the change that triggered it.
C. It makes the original change grow.
D. It changes the target to match every new reading.

Correct answer: B. It acts against the change that triggered it.
A negative feedback response counteracts a deviation. A response to a value above its target acts downward, and a response to a value below its target acts upward.

6. In a temperature loop, skin sensors signal the brain and sweat output later changes. Which event is the job of the control center, also called the integrator?

A. A region of the brain processes the input and changes its outgoing signals to sweat glands.
B. Temperature-sensitive nerve endings change the signal they send to the brain.
C. Sweat glands change how much fluid they send to the skin surface.
D. Water evaporates from the skin and carries heat away.

Correct answer: A. A region of the brain processes the input and changes its outgoing signals to sweat glands.
The integrator uses sensory input to determine a response. Its outgoing signals direct the sweat glands, which carry out the action.

7. If body temperature starts to fall, which pair of normal responses would both help oppose that change?

A. Sweat production increases and skin blood vessels widen.
B. Muscles shiver and skin blood vessels widen.
C. Sweat production increases and skin blood vessels narrow.
D. Muscles shiver and skin blood vessels narrow.

Correct answer: D. Muscles shiver and skin blood vessels narrow.
Shivering generates heat through muscle contractions. Narrower vessels near the skin reduce blood flow to the surface, which reduces heat loss.

8. In a normal short-term reflex, stretch sensors in arteries signal that pressure has briefly fallen. Which pair of responses would both tend to raise the pressure?

A. The heart pumps more blood per minute and some small arteries widen.
B. The heart pumps less blood per minute and some small arteries narrow.
C. The heart pumps more blood per minute and some small arteries narrow.
D. The heart pumps less blood per minute and some small arteries widen.

Correct answer: C. The heart pumps more blood per minute and some small arteries narrow.
Pumping more blood per minute and narrowing some small arteries both tend to raise arterial pressure. These changes oppose the initial drop.

9. Suppose blood carbon dioxide rises briefly while other influences stay the same. Which change would help bring it back toward its earlier level?

A. Breathing becomes faster and deeper, increasing carbon dioxide removal.
B. Breathing becomes slower and shallower, increasing carbon dioxide removal.
C. Breathing becomes faster and deeper, decreasing carbon dioxide removal.
D. Breathing becomes slower and shallower, decreasing carbon dioxide removal.

Correct answer: A. Breathing becomes faster and deeper, increasing carbon dioxide removal.
A rise in carbon dioxide can stimulate faster, deeper breathing. Increased ventilation carries more carbon dioxide out of the lungs, opposing the rise.

10. A one-time disturbance pushes a fictional model from its reference of 10 units down to 8. Rule A raises the value when it is below 10. Rule B lowers it when it is below 10. Which rule would amplify the initial change?

A. Neither rule
B. Rule A only
C. Both rules
D. Rule B only

Correct answer: D. Rule B only
Rule B would continue the downward change, moving the value farther from 10. Amplifying an initial change is positive feedback, even when that change is a decrease.

11. A fictional model’s target band is 47 to 53 units, including both endpoints. Successive readings are 50, 45, 47, 54, 53, and 48. How many readings are outside the band, and on which sides in order?

A. Three readings, two below and then one above
B. Two readings, first above and then below
C. Two readings, first below and then above
D. Four readings, two below and two above

Correct answer: C. Two readings, first below and then above
The only readings outside are 45 and 54. The values 47 and 53 count as within the band because it includes its endpoints.

12. A fictional model signals a lowering response above its 50-unit target and a raising response below it. A signal takes effect at the next check. The readings at checks 1 and 2 are 54 and 49. What response is in effect at check 2, and what new response is due at check 3?

A. Raising at check 2, then lowering at check 3
B. Lowering at check 2, then raising at check 3
C. Lowering at both checks
D. Raising at both checks

Correct answer: B. Lowering at check 2, then raising at check 3

The reading of 54 at check 1 schedules a lowering response for check 2. The reading of 49 at check 2 schedules a raising response for check 3.

13. In a fictional model with target 60, the true value is 66 in both runs. The control center orders a decrease if the sensor reports above 60. In run A the sensor reports 66 and the effector receives the order but stays idle. In run B the sensor reports 60, so the center sends no order. Which stage fails first in each run?

A. Effector in both runs
B. Sensor in run A and effector in run B
C. Control center in both runs
D. Effector in run A and sensor in run B

Correct answer: D. Effector in run A and sensor in run B

In run A, sensing and signaling work as described, but the effector stays idle despite the order. In run B, the first discrepancy is the sensor’s reading of 60 when the true value is 66.

14. A fictional model rises above its target to 36 units. Before the next check, an outside disturbance adds 7 units while the feedback response subtracts 5. What is the next reading, and how does the feedback act on the original rise?

A. 38 units. The feedback opposes the rise.
B. 38 units. The feedback amplifies the rise.
C. 31 units. The feedback opposes the rise.
D. 48 units. The feedback amplifies the rise.

Correct answer: A. 38 units. The feedback opposes the rise.

Add both signed effects to get 36 + 7 − 5 = 38. The feedback acts downward against the original rise, while the larger outside effect makes the net change upward.

15. A fictional model has a target of 60 units. On one step, a reading of 72 falls to 69, while a separate run starting at 52 rises to 54. Each step corrects the same fraction of the current gap, with no outside change. If another run starts at 44, what is its reading after two steps?

A. 52 units
B. 48 units
C. 51 units
D. 56 units

Correct answer: C. 51 units

In the first run the gap falls from 12 to 9, and in the second it falls from 8 to 6. Each step closes one quarter of the current gap. Starting at 44, the first step adds 4 to reach 48, and the second adds 3 to reach 51.