



Homeostasis: practice questions

8 questions • 27 marks • mark scheme at the back

For IB Diploma Biology, Standard Level and Higher Level (first assessment 2025). **HL only** is additional higher level content, for HL students only.

Name

Total / 27

1 PAPER 1A STYLE

[1 mark]

Why is negative feedback, not positive feedback, used in homeostasis?

- A. ☐ It amplifies changes so that the response is faster.
- B. ☐ It returns a variable to the set point from values above and below it.
- C. ☐ It keeps a variable exactly at the set point without any fluctuation.
- D. ☐ It only works when a variable rises above the set point.

2 PAPER 1A STYLE

[1 mark]

Which is an effect of glucagon on its target cells?

- A. ☐ Muscle cells insert more glucose transporters into their membranes.
- B. ☐ Liver cells convert glucose to glycogen.
- C. ☐ Liver cells break down glycogen and release glucose into the blood.
- D. ☐ β cells increase their secretion of insulin.

3 PAPER 1B STYLE

[5 marks]

Two adults each drank a solution containing 75 g of glucose after fasting overnight. Their blood glucose concentration was then measured every 30 minutes (data for practice). (a) Calculate the percentage increase in blood glucose for person A between 0 and 30 minutes. [1] (b) Describe the changes in blood glucose for person A. [2] (c) Person B has type 2 diabetes. Explain the differences between the results for B and A. [2]

Blood glucose concentration (mmol L ⁻¹)		
Time (min)	Person A	Person B
0	5.0	7.5
30	8.0	12.5
60	6.5	14.0
90	5.5	13.0
120	5.0	11.5

4 PAPER 2A STYLE

[3 marks]

Outline two risk factors for type 2 diabetes and one method of treatment.

5

PAPER 2B STYLE

[7 marks]

Explain how the body temperature of a human is returned to normal after exposure to cold conditions.

[illegible]

6

PAPER 1A STYLE

[1 mark]

HL only

Which substances are present in the glomerular filtrate in Bowman's capsule of a healthy person but are normally absent from urine?

- A. ☐ Urea and water
- B. ☐ Glucose and amino acids
- C. ☐ Plasma proteins and red blood cells
- D. ☐ Sodium ions and urea

7

PAPER 2A STYLE

[5 marks]

HL only

(a) Distinguish between excretion and osmoregulation. [1] (b) Explain how the volume of urine is reduced when a person is dehydrated. [4]

[illegible]

HL only

The table shows blood flow to four organs in a person during wakeful rest and during vigorous physical activity (illustrative values for practice). (a) Calculate the percentage of total blood flow to these four organs that goes to skeletal muscle during vigorous activity. [1] (b) Compare the blood flow to the brain in the two states. [1] (c) Explain the change in blood flow to the gut. [2]

Blood flow (cm ³ min ⁻¹)		
Organ	Wakeful rest	Vigorous physical activity
Skeletal muscle	1000	12500
Gut	1400	600
Kidneys	1100	600
Brain	750	750

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B [1]

2. [1]

C C [1]

3. [5]

- (a) $(8.0 - 5.0) \div 5.0 \times 100 = 60\%$ [1]
- (b) rises to a peak (8.0 mmol L^{-1}) at 30 minutes [1]
- (b) then falls back to the starting value / 5.0 mmol L^{-1} by 120 minutes [1]
- (c) B starts higher / rises higher / stays high (above 11 mmol L^{-1} at 120 min) [1]
- (c) B's target cells are resistant / less responsive to insulin [1]
- (c) so liver / muscle cells absorb less glucose / convert less to glycogen [1]
- (c) A secretes insulin which returns glucose to the set point by negative feedback [1]
- [max 5]

4. [3]

- obesity / high body mass [1]
- physical inactivity / lack of exercise [1]
- diet high in sugar / fat / refined carbohydrates [1]
- increasing age / family history / genetic factors / ethnicity [1]
- treatment: low-sugar diet / regular exercise / weight loss / drugs that improve insulin sensitivity / insulin injections [1]
- [max 3: max 2 for risk factors]

5. [7]

- negative feedback control [1]
- peripheral thermoreceptors in the skin detect the fall in temperature [1]
- hypothalamus detects / compares with the set point (about 37°C) [1]
- hypothalamus sends nerve impulses to effectors [1]
- vasoconstriction of arterioles supplying skin capillaries [1]
- less blood near the surface so less heat lost (by radiation) [1]
- shivering: rapid contractions of skeletal muscle generate heat from respiration [1]
- uncoupled respiration in brown adipose tissue releases heat instead of producing ATP [1]
- hair erection traps an insulating layer of air [1]
- hypothalamus stimulates the pituitary (TSH) to increase thyroxine secretion [1]
- thyroxine raises the metabolic rate so more heat is generated [1]
- sweating reduced / stops [1]
- behavioural responses, e.g. putting on clothes / seeking warmth [1]
- [max 7]

6. [1] **HL only**

B B [1]

7. [5] HL only

- (a) excretion is removal of metabolic wastes (e.g. urea) whereas osmoregulation is regulation of osmotic concentration / water balance [1]
- (b) osmoreceptors in the hypothalamus detect high blood osmotic concentration [1]
- (b) pituitary gland increases ADH secretion [1]
- (b) ADH causes aquaporins to move from intracellular vesicles into collecting duct cell membranes [1]
- (b) collecting duct becomes more permeable to water [1]
- (b) water reabsorbed by osmosis into the concentrated medulla [1]
- (b) medulla kept concentrated by active transport of Na^+ out of the ascending limb of the loop of Henle [1]
- [max 5]

8. [4] HL only

- (a) $12500 \div 14450 \times 100 = 86.5\%$ (accept 86–87%) [1]
- (b) the same / constant ($750 \text{ cm}^3 \text{ min}^{-1}$) in both states [1]
- (c) flow to the gut falls from 1400 to $600 \text{ cm}^3 \text{ min}^{-1}$ [1]
- (c) vasoconstriction of arterioles supplying the gut [1]
- (c) blood diverted to skeletal muscles, which need more oxygen / glucose for respiration [1]
- [max 4]