

Exercise walk-through

14.4

Homeostasis

IGCSE Biology

Hormones

adrenaline (adrenal glands) – readies the body for 'fight or flight'

insulin / **glucagon** (pancreas) – control blood glucose

testosterone / **oestrogen** – male / female development

Hormones are chemicals in the blood: **slower** but **longer-lasting** than nerve impulses.

Endocrine glands, and how hormones differ from nerves

Endocrine glands

Hormones are made by **endocrine glands**, which release them straight into the blood – so they reach every organ, and only target cells respond.

Ovaries and testes

The **ovaries** make **oestrogen** for female development; the **testes** make **testosterone** for male development.

Adrenaline

It raises the breathing rate, the **heart rate**, the blood glucose **concentration** and the pupil diameter – and the **liver** releases glucose to fuel it.

Duration

That is the real difference: a nervous response is fast and short-lived, a hormonal one slower and **longer-lasting**.

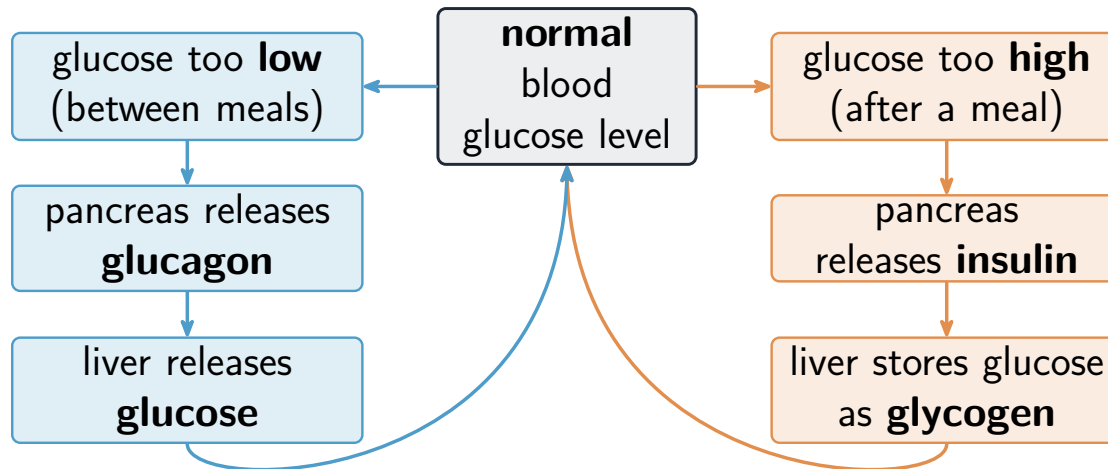
Speed, path and **duration**: three columns that separate nervous from hormonal control in any comparison question.

Homeostasis: blood glucose

Homeostasis keeps the inside steady by **negative feedback**.

- too high → insulin → store **glycogen**
- too low → glucagon → release glucose

Type 1 diabetes 1 : no insulin made.



Controlling body temperature

too hot

sweating ; **vasodilation**
– more blood to the skin loses heat

too cold

shivering ; **vasoconstriction**
– keeps heat in

Skin, blood and the set point

Too hot

You sweat, and the **arterioles** widen (**vasodilation**) so more blood flows to the skin **capillaries** and loses heat.

Too cold

Vasoconstriction narrows them, shivering releases heat from muscle, and hairs stand up to trap air.

Set point

Homeostasis keeps a constant internal **environment** by **negative feedback**: when a value moves off its **set point**, the body acts to bring it back.

Gravitropism

Plants have their own version: **gravitropism** is growth in response to **gravity** – roots down, shoots up.

The capillaries themselves do not move. It is the *arterioles* feeding them that widen or narrow.

Exercises 2.1-2.3

2.1 Define homeostasis.

[1]

2.2 Name the hormone that lowers blood glucose.

[1]

2.3 State what is meant by negative feedback.

[2]

Exercises 2.1-2.3

2.1 Define homeostasis.

[1]

2.1

- homeostasis is **keeping a constant internal environment**

2.2 Name the hormone that lowers blood glucose.

[1]

2.2

- the hormone that lowers blood glucose is **insulin**

2.3 State what is meant by negative feedback.

[2]

2.3

- a change away from the set point is **detected**
- the response **reverses** it and restores the set point

Exercises 2.4-2.5

2.4 Name the hormone released when blood glucose falls, and state its effect on the liver. [2]

2.5 Explain the effect of ADH on the kidney when a person is dehydrated. [2]

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2.4

- **glucagon**
- the liver converts stored **glycogen back into glucose**

2.5 Explain the effect of ADH on the kidney when a person is dehydrated. [2]

2.5

- more ADH makes kidney tubules **more permeable to water**
- more water is reabsorbed, so a **smaller volume of more concentrated urine** is produced

Exercise 3.1

3.1 When you are too hot, the blood vessels near the skin surface:

[1]

☐

A narrow (vasoconstriction)

B widen (vasodilation)

C disappear

D stop carrying blood

Exercise 3.1

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[1]

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A narrow (vasoconstriction)

B widen (vasodilation)

C disappear

D stop carrying blood

3.1 B

- when too hot, vessels **widen (vasodilation)** to lose more heat
- A is when too cold; C and D are false

Exercise 3.2 (a)

3.2 Blood glucose is kept steady by negative feedback.

(a) Describe what happens after a meal raises blood glucose.

[3]

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[3]

(a)

- the pancreas releases **insulin**
- the liver stores glucose as **glycogen**
- blood glucose **falls back to normal**

Exercise 3.2 (b)

3.2 Blood glucose is kept steady by negative feedback.

(b) State what causes Type 1 diabetes.

[1]

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3.2 Blood glucose is kept steady by negative feedback.

(b) State what causes Type 1 diabetes.

[1]

(b)

- Type 1 diabetes: the pancreas **cannot make insulin**

Exercise 3.3

3.3 Explain how sweating helps cool the body.

[2]

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[2]

3.3

- sweat **evaporates** from the skin
- evaporation **takes heat** from the body

Exercise 3.4 (a)

3.4 A student runs for 20 minutes on a hot day.

(a) Describe two changes in the skin that help lower body temperature, explaining how each works. [4]

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- any **two** of: more **sweat** evaporates and takes heat / **vasodilation** sends more blood to the surface / **hairs lie flat** so heat escapes

Exercise 3.4 (b)

3.4 A student runs for 20 minutes on a hot day.

(b) Explain why the student's urine is a smaller volume and more concentrated afterwards, naming the hormone involved. [4]

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(b)

- water lost in sweat makes the blood **more concentrated**
- the pituitary releases more **ADH**
- ADH makes tubules **more permeable**
- more water is reabsorbed, so **less urine**

Exercise 3.4 (c)

3.4 A student runs for 20 minutes on a hot day.

(c) After the run the student drinks a sugary sports drink and blood glucose rises. Describe the response that returns it to normal, naming the organ, the hormone and the storage compound. [4]

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(c)

- the **pancreas** detects the rise
- it releases **insulin**
- the liver converts glucose into **glycogen**
- cells take up more glucose, so the level **falls back**

Exercise 3.4 (d)

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(d)

- a change away from the norm is **detected**
- the response acts in the **opposite** direction and restores the norm