

# WJEC England Biology GCSE

## 4.3 - Homeostasis in humans

### Flashcards

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# What is homeostasis?



# What is homeostasis?

The maintenance of a stable internal environment in the body despite fluctuations in internal and external conditions.



# Why is homeostasis important?



# Why is homeostasis important?

To ensure optimum conditions for enzymes and cellular processes in the body



What type of chemicals help to ensure optimum conditions within the body?



What type of chemicals help to ensure optimum conditions within the body?

Hormones



# What is a hormone?





# What is a hormone?

- A cell signalling molecule produced by endocrine glands and released into the blood
- Travels to a target organ and binds, initiating a response



State three conditions within the body that must be controlled by homeostasis



State three conditions within the body that must be controlled by homeostasis

- Temperature
- Blood glucose concentration
- Water levels



# Why must body temperature be controlled?



# Why must body temperature be controlled?

- Enzymes work best at their optimum temperature
- Deviations from this optimum temperature decrease the rate of enzyme-controlled reactions



What is the optimum temperature for enzymes in the human body?

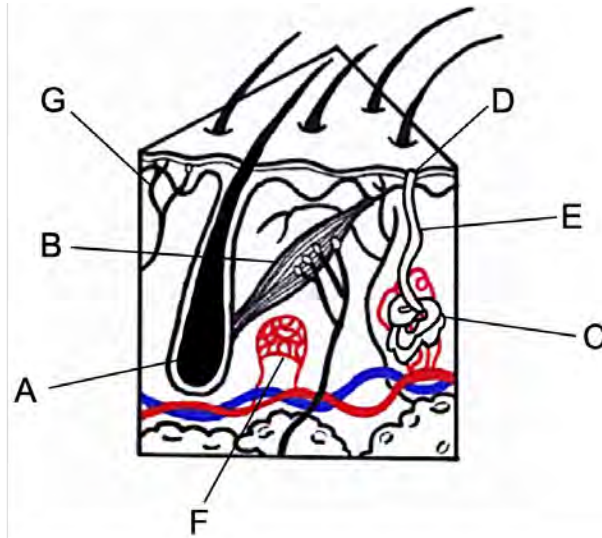


What is the optimum temperature for enzymes in the human body?

37°C



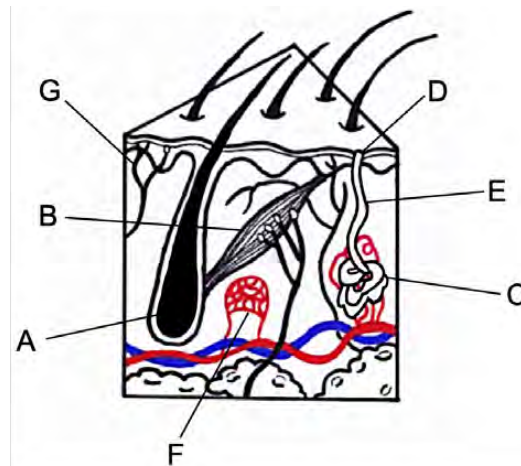
# Identify the structures of the skin labelled in the diagram below





Identify the structures of the skin labelled in the diagram below

<b>A</b>	hair follicle	<b>E</b>	sweat duct
<b>B</b>	erector muscle	<b>F</b>	blood capillaries
<b>C</b>	sweat gland	<b>G</b>	nerve fibre
<b>D</b>	sweat pore		



Outline the responses of the body to an increase in temperature above  $37^{\circ}\text{C}$  (3)



Outline the responses of the body to an increase in temperature above  $37^{\circ}\text{C}$  (3)

- Vasodilation
- Sweating
- Erector muscles relax, hairs lie flat



# What structures produce sweat?



# What structures produce sweat?

## Sweat glands



# How does sweating help to reduce body temperature?



How does sweating help to reduce body temperature?

Heat energy is used to evaporate sweat.  
Increased heat transfer from the skin to the environment decreases body temperature.



# What is vasodilation?





# What is vasodilation?

- Dilation of blood vessels near the skin surface
- Blood flows closer to the skin surface
- Greater heat loss to the surroundings



Outline the responses of the body to a decrease in temperature below  $37^{\circ}\text{C}$  (4)



Outline the responses of the body to a decrease in temperature below  $37^{\circ}\text{C}$  (4)

- Vasoconstriction
- Shivering
- Hair erector muscles contract
- Little sweat is produced



How does shivering help to increase body temperature?



How does shivering help to increase body temperature?

Involuntary contraction of muscles generates heat energy from respiration



How does the contraction of hair erector muscles help to increase body temperature?



How does the contraction of hair erector muscles help to increase body temperature?

Hairs stand on end creating pockets of air between hairs and a layer of insulation.



# What is vasoconstriction?





# What is vasoconstriction?

- Constriction of blood vessels near skin surface
- Less blood flows close to the skin surface
- Less heat loss to the surroundings



# Why must blood glucose concentrations be controlled?



# Why must blood glucose concentrations be controlled?

- If blood glucose concentrations rise too high the body risks dehydration
- If blood glucose concentrations become too low the rate of cellular respiration decreases



Which organ is responsible for the maintenance of blood glucose concentrations?



Which organ is responsible for the maintenance of blood glucose concentrations?

Pancreas



# How are blood glucose concentrations controlled?



# How are blood glucose concentrations controlled?

Blood glucose is controlled by the action of insulin (hormone) which is secreted by the pancreas.



Describe the role of insulin in the regulation of blood sugar levels





# Describe the role of insulin in the regulation of blood sugar levels

- Causes liver and muscle cells to increase their uptake of glucose from the blood
- Glucose is converted into glycogen, a storage molecule



Describe the role of glucagon in the regulation of blood sugar levels (higher)



Describe the role of glucagon in the regulation of blood sugar levels (**higher**)

- Causes the breakdown of glycogen to glucose in the liver
- Glucose is released into the blood



What is the control of blood glucose concentration an example of? (higher)



What is the control of blood glucose concentration  
an example of? (higher)

Negative feedback



Describe what happens when blood  
glucose concentrations become too high  
(higher)



## Describe what happens when blood glucose concentrations become too high (**higher**)

- Blood glucose concentration increases above a set point
- Pancreas secretes **insulin** and stops producing glucagon
- Liver cells convert glucose to glycogen which is stored
- Blood glucose concentration decreases, returning to normal level



Describe what happens when blood  
glucose concentrations become too low  
(higher)





# Describe what happens when blood glucose concentrations become too low (**higher**)

- Blood glucose concentration decreases below a set point
- Pancreas secretes **glucagon** and stops producing insulin
- Liver cells convert glycogen into glucose which is released into blood
- Blood glucose concentration increases, returning to normal level



# What is diabetes?



# What is diabetes?

A condition where the homeostatic control of blood glucose levels stops working.



# What are the two types of diabetes?



# What are the two types of diabetes?

- Type 1 diabetes
- Type 2 diabetes



# What is the cause of type 1 diabetes?



## What is the cause of type 1 diabetes?

- Immune system attacks and destroys insulin-producing cells
- ∴ pancreas does not produce enough insulin



# How is type 1 diabetes treated? (3)





## How is type 1 diabetes treated? (3)

- Daily insulin injections at meal times
- Managing diet (limiting intake of refined sugars)
- Regularly testing blood glucose levels



# What is the cause of type 2 diabetes?



# What is the cause of type 2 diabetes?

Person develops insulin resistance  
(often due to obesity)



# How is type 2 diabetes treated? (3)



## How is type 2 diabetes treated? (3)

- Managing diet (limiting intake of refined sugars)
- Regular exercise
- Pancreatic tissue transplant



# What is osmoregulation?



# What is osmoregulation?

The maintenance of constant water levels in the body fluids of an organism



# Why is osmoregulation important? (2)





## Why is osmoregulation important? (2)

- Prevents cells bursting or shrinking when water enters or leaves by osmosis
- Cellular reactions occur in aqueous solution  $\therefore$  water levels affect concentrations and the rate of reactions in cells



# Describe the functions of the kidneys

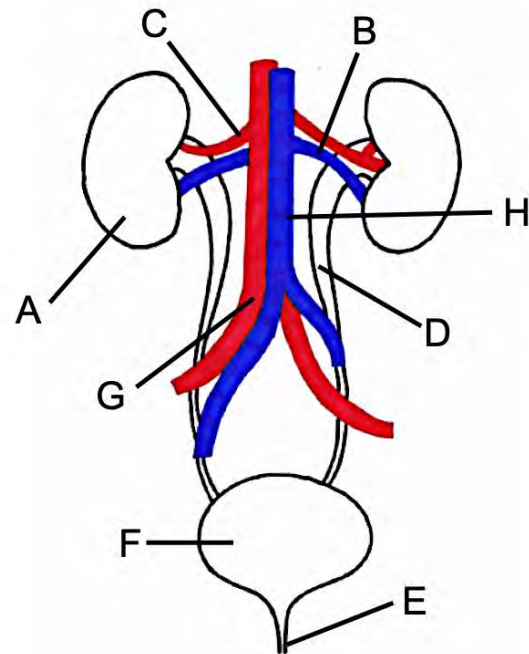


## Describe the functions of the kidneys

- Removes toxic waste substances from the body
- Maintain the water levels of body fluids
- Control the volume and concentration of urine

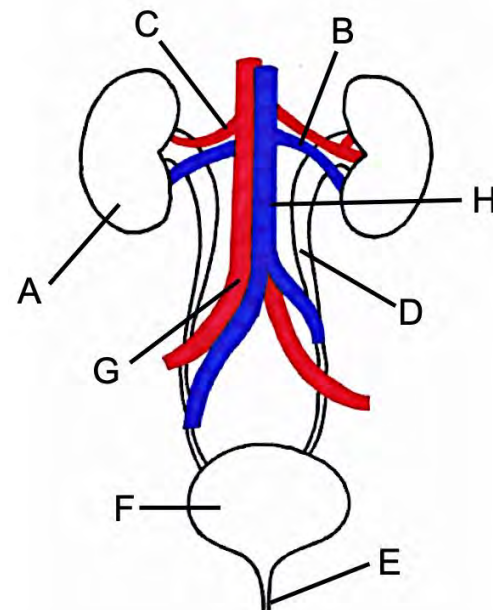


Identify the structures of the excretory system labelled in the diagram



# Identify the structures of the excretory system labelled in the diagram

<b>A</b>	kidney	<b>E</b>	urethra
<b>B</b>	renal vein	<b>F</b>	bladder
<b>C</b>	renal artery	<b>G</b>	aorta
<b>D</b>	ureter	<b>H</b>	vena cava



# What is the function of the renal artery?



What is the function of the renal artery?

Supplies blood to the kidneys



# What is the function of the renal vein?





What is the function of the renal vein?

Drains blood from the kidneys



# What is the function of the ureter?



What is the function of the ureter?

Takes urine to the bladder from the kidneys



# What is the function of the urethra?



What is the function of the urethra?

Releases urine from the bladder, out of the body



# Describe the structure of the kidneys



## Describe the structure of the kidneys

- Outer cortex
- Pelvis (leads to ureter)
- Inner medulla



# What is a nephron?





# What is a nephron?

Functional unit of the kidney where filtration and selective reabsorption takes place

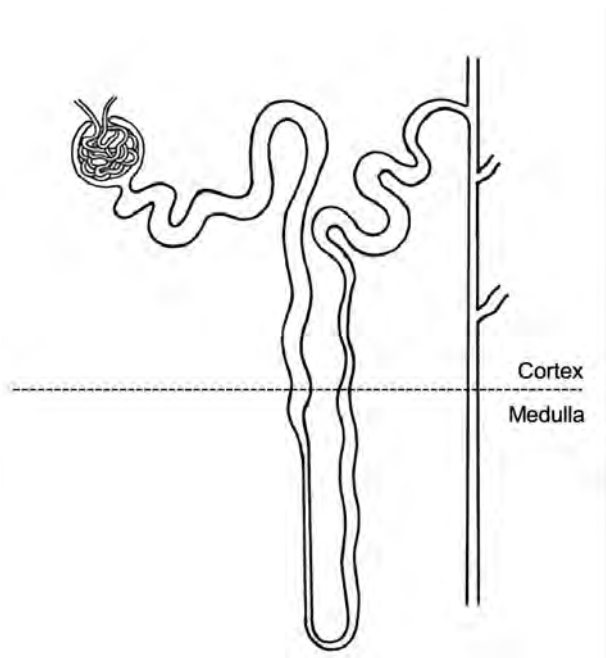


Where are nephrons found within the kidneys?

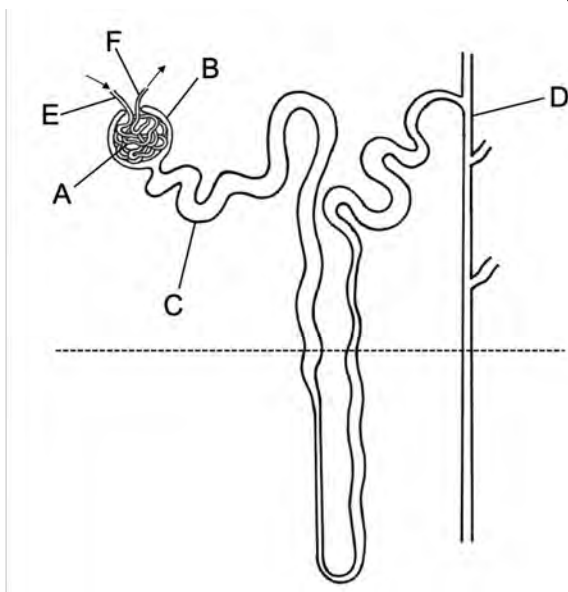


# Where are nephrons found within the kidneys?

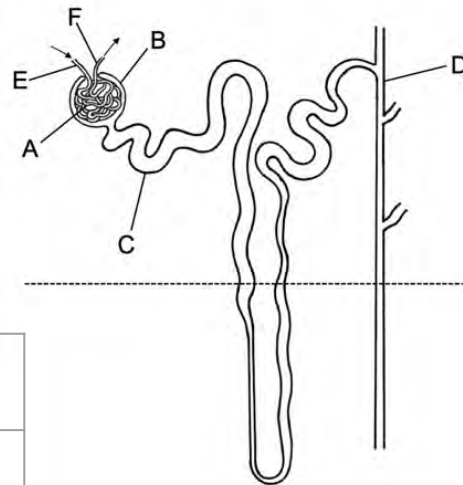
Part of the nephron is located in the medulla and part in the cortex



# Identify the structures of the nephron labelled in the diagram



# Identify the structures of the nephron labelled in the diagram



<b>A</b>	capillary knot	<b>D</b>	collecting duct
<b>B</b>	Bowman's capsule	<b>E</b>	Arteriole to capillary knot
<b>C</b>	tubule	<b>F</b>	Arteriole from capillary knot



What are the three stages involved in the formation of urine?



What are the three stages involved in the formation of urine?

- Filtration
- Selective reabsorption
- Osmoregulation



# Describe filtration in the kidneys





## Describe filtration in the kidneys

- Blood flows through the capillary knot under high pressure
- Small molecules (e.g. urea, glucose), water and salts are filtered out of the blood and into the Bowman's capsule



Why is there a build-up of pressure in the capillary knot?



Why is there a build-up of pressure in the capillary knot?

Arteriole leading into the capillary knot is wider than the arteriole taking blood from the capillary knot



Why do large molecules (e.g. red blood cells, proteins) remain in the blood?



Why do large molecules (e.g. red blood cells, proteins) remain in the blood?

They are too large to fit through the pores in the capillary walls



Which substances are selectively reabsorbed from the nephron tubule?



Which substances are selectively reabsorbed from the nephron tubule?

- All sugars
- Some water
- Some ions



What happens to the molecules not selectively reabsorbed?





What happens to the molecules not selectively reabsorbed?

They travel down the kidney tubule as urine and are transported to the bladder via the ureter. Here they are stored and eventually excreted.



# What is urine?



## What is urine?

- Waste product of the kidney
- Contains urea, excess water, excess ions



What may blood or cells in the urine indicate?



What may blood or cells in the urine indicate?

Kidney disease



If blood water levels become too high,  
the kidney produces more \_\_\_\_\_ urine



If blood water levels become too high, the kidney produces more \_\_\_\_\_ urine

Dilute



If blood water levels become too low, the kidney produces more \_\_\_\_\_ urine





If blood water levels become too low, the kidney produces more \_\_\_\_\_ urine

Concentrated



How is the concentration and volume of urine controlled? (higher)



How is the concentration and volume of urine controlled? (**higher**)

Controlled by the secretion of anti-diuretic hormone (ADH)



What produces ADHD? (higher)



What produces ADH? (**higher**)

Pituitary gland



Describe how ADH affects the reabsorption of water from the kidney tubules (**higher**)



Describe how ADH affects the reabsorption of water from the kidney tubules (**higher**)

- Increases permeability of collecting duct
- More water reabsorbed into blood
- More concentrated urine produced



# Describe the composition of blood





# Describe the composition of blood

Contains:

- Cells
- Proteins
- Water
- Glucose
- Salts
- Urea



# Describe the composition of filtrate



# Describe the composition of filtrate

Contains:

- Water
- Glucose
- Salts
- Urea



# Describe the composition of urine



# Describe the composition of urine

Contains:

- Some water
- Some salts
- Urea



Describe what happens to an animal cell if it is placed into a hypotonic solution



## Describe what happens to an animal cell if it is placed into a hypotonic solution

- Higher concentration of water in surrounding solution
- Water molecules move down their water concentration gradient into the cell by osmosis
- Pressure inside the cell increases, cell bursts (lysis)



Describe what happens to an animal cell  
if it is placed into a hypertonic solution





# Describe what happens to an animal cell if it is placed into a hypertonic solution

- Lower concentration of water in surrounding solution
- Water molecules move down their water concentration gradient out of the cell by osmosis
- Pressure inside the cell decreases, cell shrinks (crenation)



Describe what happens to an animal cell  
if it is placed into an isotonic solution



Describe what happens to an animal cell if it is placed into an isotonic solution

No net movement of water molecules into or out of the cell



How does an increase in external temperature affect the concentration of water in body cells? **(higher)**



How does an increase in external temperature affect the concentration of water in body cells? (**higher**)

- External temperature increases
- Water loss via sweating
- Body fluids become more concentrated
- Body cells lose water by osmosis

