

A level Biology



Transition workbook – Year 11 to Year 12

Specification: OCR A level Biology A (H420)

The specification overview.

Content Overview	Assessment Overview	
Content is split into six teaching modules: • Module 1 – Development of practical skills in biology • Module 2 – Foundations in biology • Module 3 – Exchange and transport • Module 4 – Biodiversity, evolution and disease • Module 5 – Communication, homeostasis and energy • Module 6 – Genetics, evolution and ecosystems Component 01 assesses content from modules 1, 2, 3 and 5. Component 02 assesses content from modules 1, 2, 4 and 6. Component 03 assesses content from all modules (1 to 6).	Biological processes (01) 100 marks 2 hour 15 minutes written paper	37% of total A level
	Biological diversity (02) 100 marks 2 hour 15 minutes written paper	37% of total A level
	Unified biology (03) 70 marks 1 hour 30 minutes written paper	26% of total A level
	Practical Endorsement in biology (04) (non exam assessment)	Reported separately (see section 5f)

All components include synoptic assessment.

Full specification:



Tasks to complete over summer, essential for a strong start to A level Biology in September.
Answers to this booklet will be provided in September to check your understanding. You should aim to talk to your teachers about any areas you found difficult or did not understand.

Part 1 – Practical key terminology

When is a measurement valid?	when it measures what it is supposed to be measuring
When is a result accurate?	when it is close to the true value
What are precise results?	when repeat measurements are consistent/agree closely with each other
What is repeatability?	how precise repeated measurements are when they are taken by the <i>same</i> person, using the <i>same</i> equipment, under the <i>same</i> conditions
What is reproducibility?	how precise repeated measurements are when they are taken by <i>different</i> people, using <i>different</i> equipment
What is the uncertainty of a measurement?	the interval within which the true value is expected to lie
Define measurement error	the difference between a measured value and the true value
What type of error is caused by results varying around the true value in an unpredictable way?	random error
What is a systematic error?	a consistent difference between the measured values and true values
What does zero error mean?	a measuring instrument gives a false reading when the true value should be zero
Which variable is changed or selected by the investigator?	independent variable
What is a dependent variable?	a variable that is measured every time the independent variable is changed
Define a fair test	a test in which only the independent variable is allowed to affect the dependent variable
What are control variables?	variables that should be kept constant to avoid them affecting the dependent variable

Fill in the gaps:

A variable that is changed is the _____ variable.
 A variable that is measured is the _____ variable.
 Variables that are kept the same are called _____ variables.
 Improving reliability involves increasing the number of _____.
 A graph should include a clear _____ and labelled _____.

Part 2 – Maths skills

1. There is a wide range of prefixes. Most of the quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, we would quote a distance of 33000 m as 33 km.

The most common prefixes you will encounter are given in the table.

Prefix	Symbol	Power of 10	Multiplication factor	
Tera	T	10^{12}	1 000 000 000 000	
Giga	G	10^9	1 000 000 000	
Mega	M	10^6	1 000 000	
kilo	k	10^3	1000	
deci	d	10^{-1}	0.1	1/10
centi	c	10^{-2}	0.01	1/100
milli	m	10^{-3}	0.001	1/1000
micro	μ	10^{-6}	0.000 001	1/1 000 000
nano	n	10^{-9}	0.000 000 001	1/1 000 000 000
pico	p	10^{-12}	0.000 000 000 001	1/1 000 000 000 000
femto	f	10^{-15}	0.000 000 000 000 001	1/1 000 000 000 000 000

A. Units & Conversions

Fill in:

1 mm = _____ m
1 μ m = _____ m
1 nm = _____ m
1 cm³ = _____ litres
1 mL = _____ cm³

Convert:

0.00224 m = _____ mm
104 μ g = _____ g
10 μ g = _____ ng

B. Standard Form

Convert to standard form:

0.3 = _____
0.0056 = _____
0.0000016 = _____

C. Calculations

Calculate the % decrease:

80 rabbits → decrease of 10% → new population = _____

Write the formula for:

Circumference = _____
Area of circle = _____

Part 3 – Subject knowledge

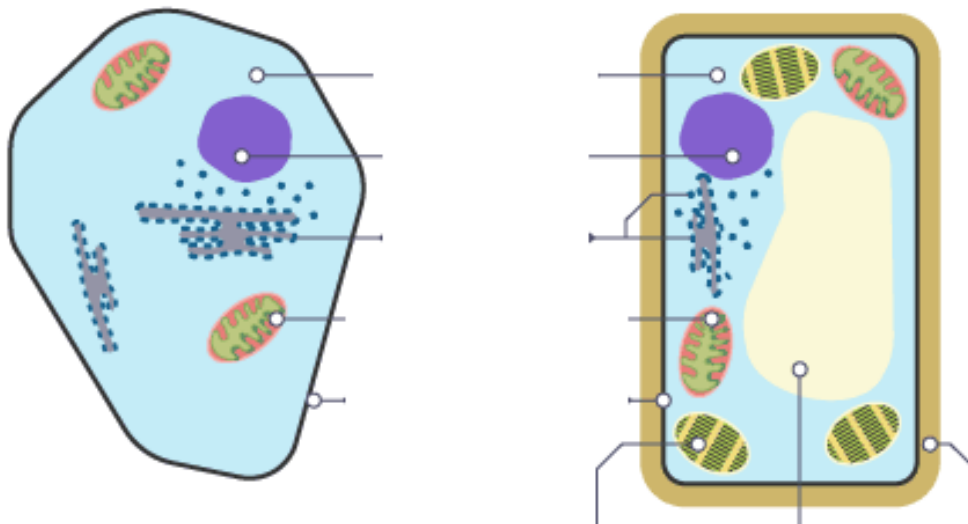
Section A: Cells and core processes

Watch the videos and complete the matching activity.

Video title	QR code
1. Cells	
2. Enzymes and factors affecting them	
3. Brain and nervous system	 Brain Nervous system

1. Cells

Cells – you need to be able to label a cell diagram and link structure to function
Label the 2 cells and state if they are a plant or animal cell. Which cell is bigger?



Specialised cells (you must be able to identify them as well), link to their functions:

red blood cell	Produce antibody to destroy pathogens, part of the specific immune response, increase when have an infection
white blood cell - phagocyte	Conduct electrical impulses within the nervous system, long axon covered with insulating myelin
white blood cell - B cell	Haploid gamete (half the normal no. of chromosomes), long tail for motility, contain digestive enzymes in acrosome to allow fertilisation of female gamete
nerve (neurone) cell	Waft mucus using cell surface membrane extensions, found in trachea and fallopian tubes
ovum	Transport oxygen bound to haemoglobin, biconcave shape to increase SA, flexible to squeeze through capillaries
sperm cell	2 of these form a stomata, can swell up with water to open stomata, shrink to close stomata
guard cell	Haploid cell (half the normal no. of chromosomes), large gamete, produced in ovaries
ciliated epithelial cell	Digest pathogens using enzymes, increase when have an infection

Place a tick if the feature is present in the cell

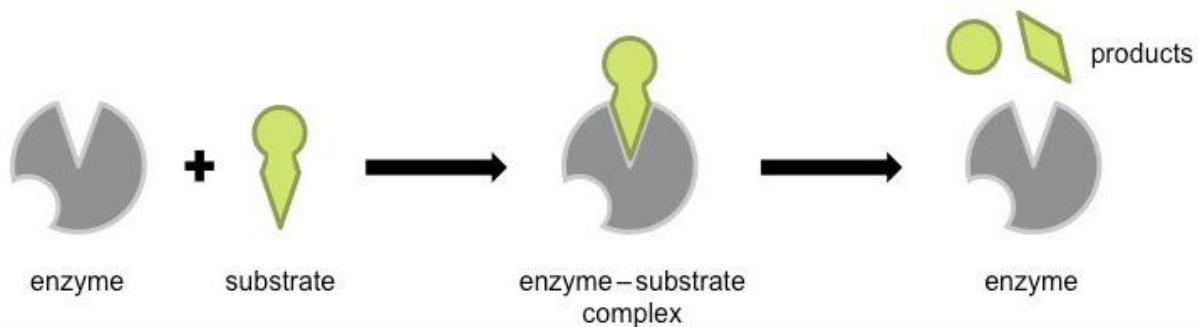
	Plant cell	Animal cell	Bacterial cell (smallest cell)
Cell membrane			
Cell wall			
Cytoplasm			
Nucleus			
Plasmid			
Mitochondria			
Flagellum			
Large vacuole			
Chloroplast			

Match the cell structure to its function:

Nucleus	Separates the contents of the cell and its surroundings. Controls the movement of substances such as oxygen, glucose and carbon dioxide into and out of the cell.
Mitochondria (1 mitochondrion)	Many chemical reactions needed to carry out life process take place here. It also contains organelles
Ribosome	Organelle that contains DNA. It controls the cells activities.
Cell Wall	Organelle that contains chlorophyll, a green pigment that absorbs light energy for photosynthesis.
Cell membrane	Made of tough cellulose to support the cell and allows it to keep its shape.
Large Vacuole	Organelles in which aerobic respiration occurs (oxygen and glucose react to release energy needed by the cell). Very small and cannot be seen easily through a light microscope
Chloroplasts	Membrane of the nucleus, allows molecules to enter/exit and messenger RNA to exit in protein synthesis
Cytoplasm	Space in the cytoplasm filled with cell sap (mainly water and ions), it is membrane bound, helping to support the plant by keeping the cell rigid.
Nuclear membrane	Site of the second stage of protein synthesis (translation).

2. Enzymes

Label the active site of the enzyme



Enzymes are _____ catalysts, speeding up a reaction and lower the _____ energy of a reaction. An enzyme is _____ to one substrate due to its shape of the _____ which is complementary to the substrate, this is known as the _____ and _____ hypothesis. Enzymes are made of _____. They remain _____ in a reaction and are not used up.

Enzymes can be _____ and break down large molecules eg protein into _____

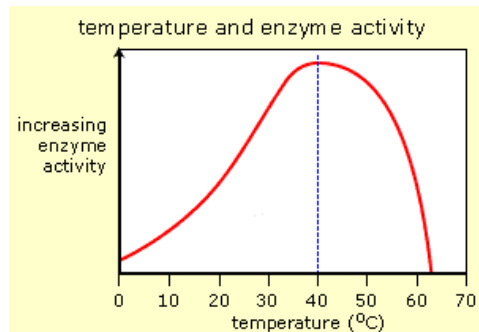
Or _____ and build up large molecules eg glucose into _____

So in a reaction digesting lipids what happens to the pH?

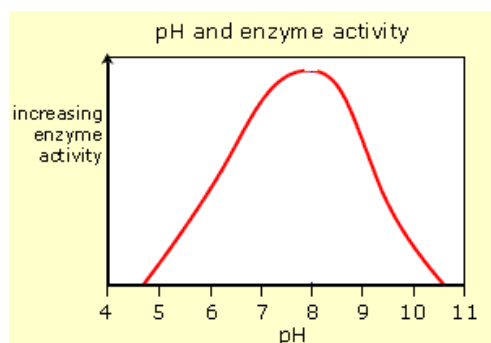
In a reaction digesting protein what happens to the pH?

How could you measure these changes accurately?

Factors affecting enzymes include: _____, _____ and _____ of substrate or enzyme. High _____ and non-optimal _____ will cause an enzyme to _____ where the active site has lost its shape and is no longer complementary to its specific _____, so no _____ form and this is irreversible.

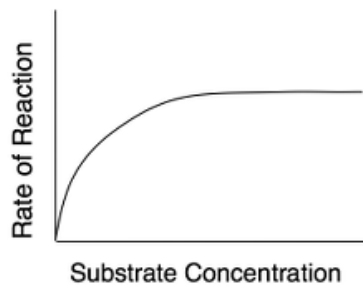


On the diagram indicate where there is increasing kinetic energy and collisions
The optimum temperature
Where the enzyme starts to denature
Where all enzymes are denatured



Note: change in pH does not change the KE

On the diagram indicate the optimum pH
Indicate where all the enzyme has denatured
Indicate where the active site starts to change shape
What enzyme would have an optimal pH of 1-2? Where is it found?



- A. Indicate where the active sites are not full
- B. Indicate when the active sites are full
- C. Indicate when the enzyme is the limiting factor

Amylase and effect of pH on rate of digestion of starch

Rate calculations – you need to be able to do this

Rate = how quickly a reaction is in relation to time, **calculate by $1 / \text{time}$** – must include units

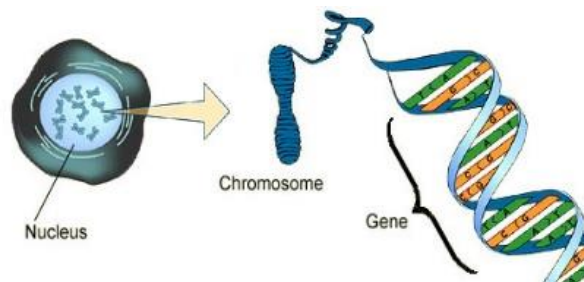
1. Amylase digested starch at pH 6 in 20s, what is the rate?
2. Amylase digested starch at pH4 in 50s, what is the rate?
3. Amylase digested starch at pH 7 in 10s, what is the rate?

Section B: Nucleic acid

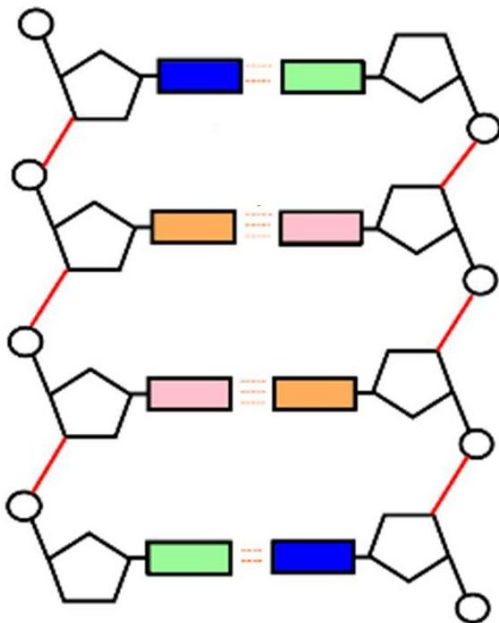
Watch the videos and complete the matching activity.

Video title	QR code
1. DNA structure	
2. Cell cycle and division	  
3. Protein synthesis	

1. DNA structure



On the diagram of DNA label the: base, phosphate, deoxyribose sugar, hydrogen bond



The structure of DNA was determined by X Ray _____ by Rosalind Franklin then the model of DNA was determined by Watson and _____.

They showed that:

- DNA has a _____ helix shape.
- They determined the diameter of DNA
- It has _____ strands
- The backbone is made of _____ and _____
- The bases are _____, _____, _____, _____, they are joined by weak _____ bonds
- The complementary pairings of the bases are _____ & _____ and _____ & _____
- A length of DNA is a _____ and it codes for a _____

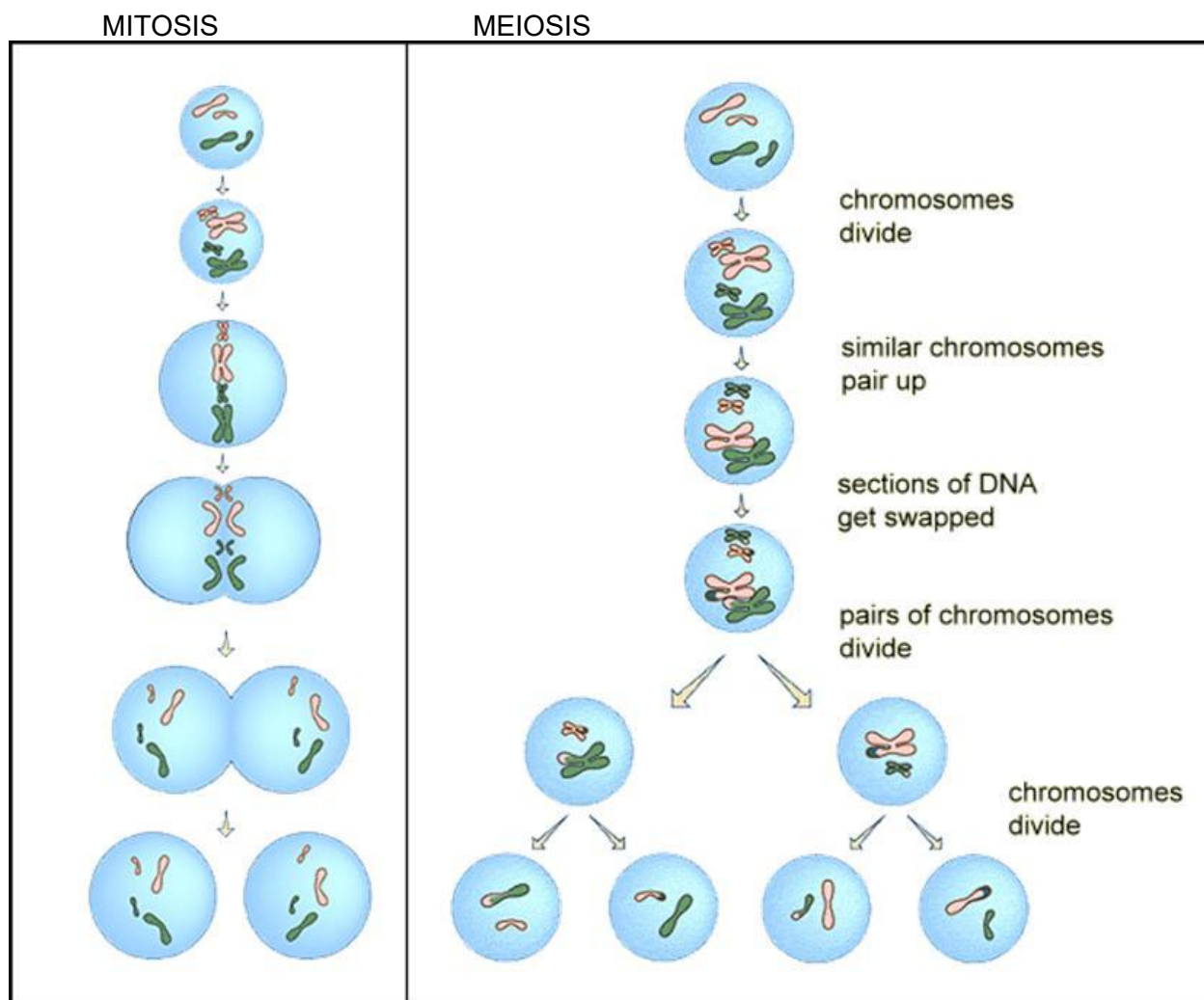
1. If a section of DNA has 33% Adenine (A) bases, what percentage will be Guanine (G)?
2. DNA is a polymer, what makes up the monomer?
3. Describe the difference between a chromosomes, gene and DNA

DNA vs RNA

	DNA	RNA (mRNA and tRNA – used in protein synthesis)
Sugar	Deoxyribose sugar	Ribose sugar
Bases present	A, T, C, G	A, U, C, G
Number of strands	1	2
Can leave the nucleus	NO	YES

2. Mitosis and meiosis

Mitosis produces _____ cells, meiosis produces _____ (sperm and ova)



On the diagrams above place the labels in the right places: chromatids separate, chromosomes separate, DNA copied, spindle fibres attach to centromere, diploid cells, haploid cells, cytokinesis. Label the stages of mitosis (these are **not** in the right order: metaphase, telophase, prophase, anaphase)

Mitosis purpose: replace _____, repair _____, _____ reproduction

Mitosis – fill in the gaps, using the diagram above

- Before mitosis occurs, the DNA must be _____, this creates a chromosome made of 2 _____
- In mitosis the chromosomes line up on the _____
- The spindle _____ produced by the _____ attach to the _____ (the middle of the chromosome), these then shorten and pull the _____ apart to the _____ (ends) of the cell
- The cell then divides into 2, each cell contains the _____ number of chromosomes and is called a _____ cell and they are genetically _____

After an animal or plant cell has divided by mitosis what process must happen to the cells to become a specialised cell (eg red blood cell, white blood cell, ciliated epithelial cell, spongy mesophyll cell, guard cell)?

Meiosis – fill in the gaps, using the diagram above

- Before meiosis occurs, the DNA must be _____
- In meiosis the chromosomes line up in their pairs on the _____ and they can swap DNA, this is called _____ over.
- The spindle _____ produced by the _____ attach to the _____ (the middle of the chromosome), these then shorten and pull one of the _____ to each _____ (ends) of the cell
- The cell then divides into 2, each cell contains _____ the number of chromosomes as the parent cell and is called a _____ cell and they are genetically _____
- These 2 cells go on to divide again. This time the spindle fibres separate the _____ to pull each one to the pole of the cell
- Each of the 2 cells then divide again to create a total of ____ cells, each one is genetically _____ and are _____ as it contains half the number of chromosomes compared to the parent cell

Compare and contrast mitosis and meiosis – fill in the table

	Mitosis	Meiosis
Number of cell produced		
Number of cell divisions		
Type of cells produced		
Genetic content of cells		
Genetically the same or different?		
Crossing over occurs		

3. Protein synthesis

Protein synthesis

A gene codes for a protein and is made by protein synthesis in the _____. All cells need protein eg enzymes, transport proteins, hormones.

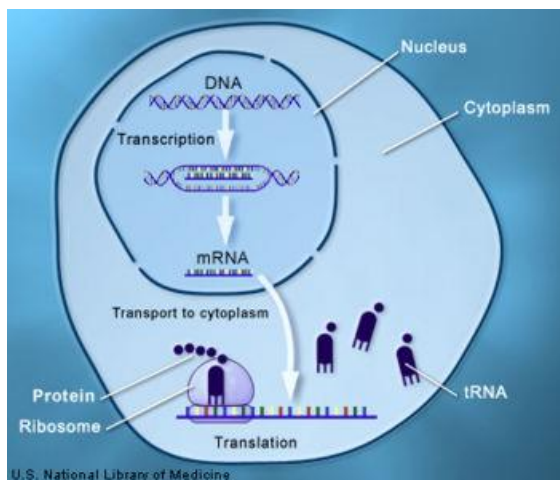
Protein synthesis involves 2 stages which are enzyme controlled:

Stage 1 TRANSCRIPTION –a complementary strand of mRNA is formed from a section of DNA

- The DNA of a gene _____, separating the DNA into 2 strands
- The enzyme RNA _____ binds to a non coding region of DNA in front of the gene
- Complimentary RNA nucleotides add in to form a strand of _____
- A pairs with ____ and C pairs with ____ (note no T (thymine), replaced by U (uracil))
- mRNA leaves the nucleus through _____ in the nuclear membrane, DNA zips back up into its double helix

Stage 2 TRANSLATION –a protein is formed using the mRNA. mRNA goes to a ribosome in the cytoplasm

- Each set of 3 bases on the mRNA form a _____
- Each set of 3 bases on the tRNA form an _____
- tRNA carrying specific _____ acids enter the ribosome, they have complimentary anticodons to the mRNA codons (A-U and C-G)
- The amino acids join up with _____ bonds to form the protein
- The protein then folds to produce a specifically shaped protein eg an enzyme with its _____ site



Covert the bases:

DNA	ATG		
mRNA codon		CGA	
tRNA anticodon			UAC

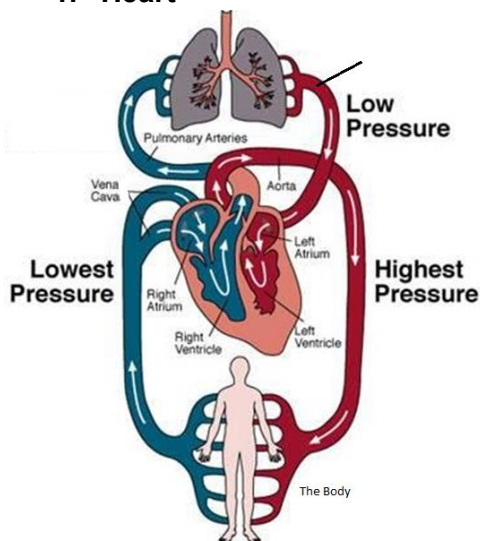
1. A protein is made of 153 amino acids, how many bases there were in the DNA?
2. A gene is made of 186 bases, how many amino acids will make up the protein?
3. What is the role of mRNA and tRNA in protein synthesis?

Section C: Physiology

Watch the videos and complete the matching activity.

Video title	QR code
1. Heart	
2. Kidney	 
3. Homeostasis (blood glucose control and thermoregulation)	 

1. Heart



The pulmonary artery takes blood from the _____ to the _____ where the blood is oxygenated

The pulmonary vein takes blood from the _____ to the _____, entering into the _____ atrium

The aorta takes _____ blood from the _____ hand side of the heart to the whole _____, as all arteries branch off the aorta.

The _____ takes deoxygenated blood from the body back to the _____ hand side of the heart and enters into the _____ atrium.

Blood from the left hand side of the heart has to be pumped to the whole body so blood is under _____ pressure. The wall of the left _____ is _____ than the right ventricle wall as when it contracts it generate the high pressure of the blood.

Blood leaving the right hand side of the heart in the pulmonary _____ is under low pressure as it only has to travel to the _____. Between the atria and ventricles there are atrioventricular (or bicuspid/tricuspid) _____ that prevent the backflow of blood, so blood in the ventricles can not re enter the _____. Between the ventricles and the aorta/pulmonary artery there are valves called the _____ valves, when these close they prevent back flow of blood into the _____. If backflow of blood occurred there would be less _____ blood delivered to the body, affecting respiration

The **Cardiac output** (CO) is the volume of blood being pumped by the heart into the circulatory system in one minute and relates specifically to the output from the left ventricle.

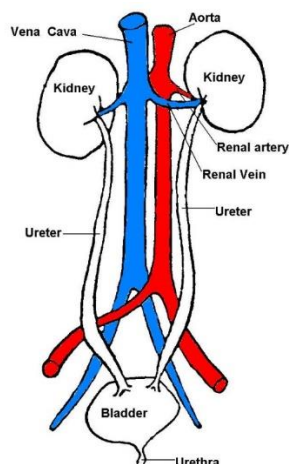
The cardiac output depends on the **stroke volume** (the volume of blood pumped out of the ventricle each contraction) and the **heart rate** (the number of beats per minute).

What is the formula for CO? CO =

2. Kidney

Kidneys and excretion – they are important in homeostasis

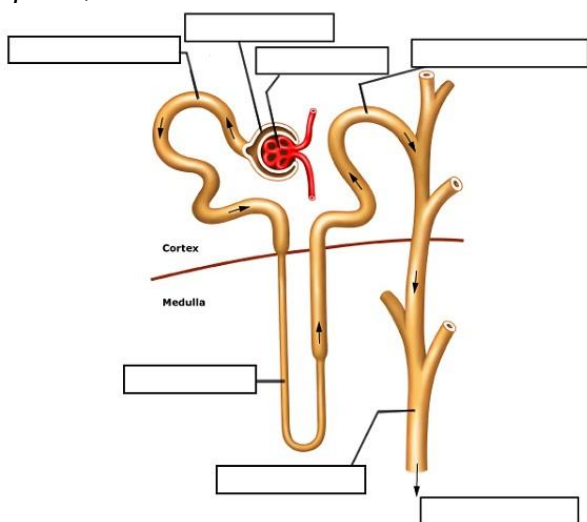
Excretion definition:



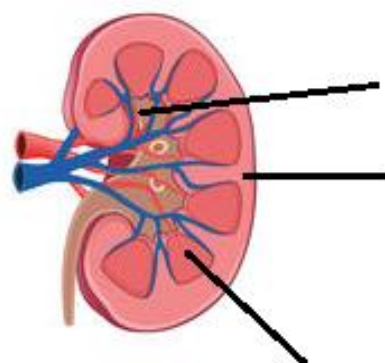
The _____ artery supplies blood to the kidneys. This is a branch of the _____. Blood leaves the kidney in the renal _____ and this joins the _____ which returns blood to the _____.

Urine leaves the kidney in the _____. Urine is stored in the _____. Urine leaves the body in the _____. Urine contains: _____, ions, _____ (waste product from the breakdown of excess amino _____, formed in the _____ by the process of deamination), and hormones. The kidney is made of 1000s of _____.

The Nephron: complete the boxes using the following labels: *PCT (Proximal Convolved Tubule)*, *loop of Henle*, *Glomerulus*, *collecting duct*, *DCT (2nd tubule – Distal Convolved Tubule)*, *Bowman's capsule*, *ureter*



Can you label the cortex, medulla and pelvis tissues, ureter, on this diagram:



Now add on to show where the following processes occur: *ultrafiltration*, *selective reabsorption*, *ADH acts to reabsorb more water*

What is in the blood that must be removed as it is toxic?

Where is this molecule produced and by what process?

What other molecules are in urine?

Key processes in urine formation:

3. Homeostasis

Thermoregulation - an important part of homeostasis

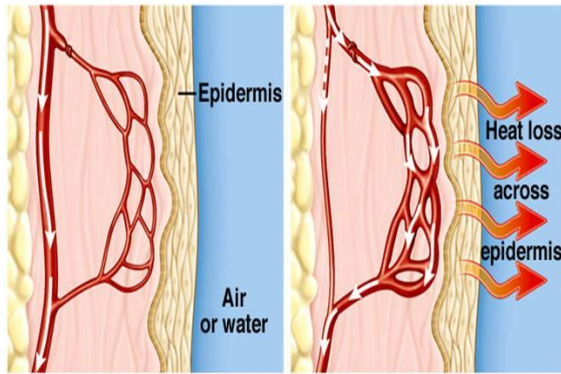
It is essential that endotherms (eg humans) maintain their body temperature within narrow limits, by removing excess heat when hot and retaining heat when cold.

This is to maintain the optimum temperature for _____ controlled reactions of the body

The part of the brain that controls thermoregulation is the _____

Central _____ receptors in the body and peripheral _____ receptors in the _____ send electrical impulses to this part of the brain which coordinates the response

Human body temperature is maintained at around _____.



Vasoconstriction

Vasodilation

On the diagram label: arteriole, capillary loop, increased blood flow, decreased blood flow

Remember it is the **arterioles** that lead to the capillaries that vasoconstrict or vasodilate, **not** the capillary (capillaries do not have smooth muscle to allow this)

This changes the blood flow near the skin surface (epidermis)

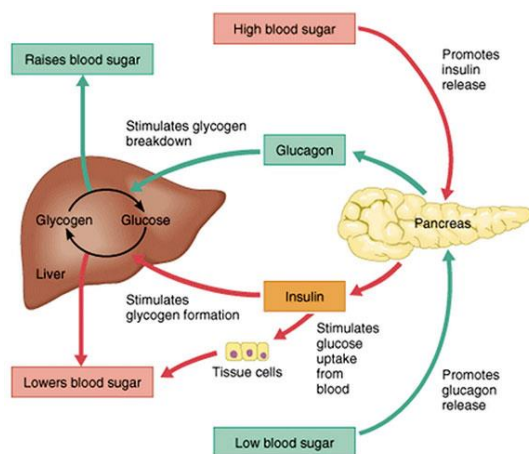
The capillaries DO NOT MOVE closer to the skin surface (they can't move!)

Fill in the boxes:

	When body temperature rises above 37°C	When body temperature drops below 37°C
Erector pili muscles attached to hair follicle		
Hair position on body		
Sweat production		
Blood vessels (arteries & arterioles) close to the skin		
Blood flow to skin surface in capillaries and heat loss by radiation		
Involuntary muscles		

Blood glucose control – another form of homeostasis

Hormones are chemicals secreted by endocrine _____ and transported in the _____ to act on target organs. Their secretion is controlled by _____ **feedback**, which allows control mechanisms to fluctuate and self-adjust.



Blood glucose is controlled by 2 hormones _____ and _____

Both hormones are produced in the _____

The hormones are transported in the _____

Excess glucose can be converted into _____ which is stored in _____ cells and _____ cells

High glucose concentration in the blood (eg from having eaten carbohydrates), fill in the gaps:

- High blood glucose detected by cells in the _____
- The hormone _____ is secreted by the pancreas
- This causes muscle and _____ cells to take up more glucose from the blood and it is converted into _____ and stored in the cells
- This lowers the blood glucose level, so there is _____ feedback and _____ production decreases to prevent a further lowering of blood glucose (hypoglycaemia)

Low glucose concentration in the blood (eg from having exercised, not eaten _____ for a while)

- Low blood glucose detected by cells in the _____
- The hormone _____ is secreted by the _____
- This causes stored _____ to be converted into _____ and released into the blood
- This raises the blood glucose levels, so there is _____ feedback and production of _____ decreases to prevent a further rise in glucose (Hyperglycaemia)

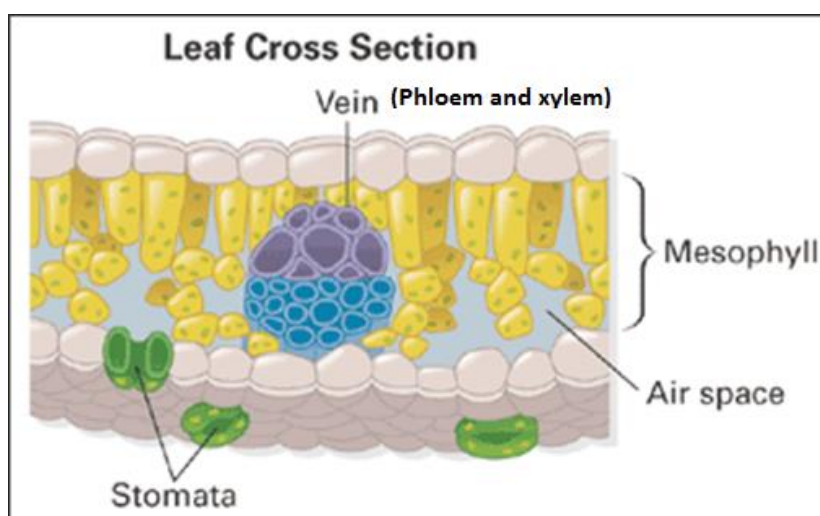
Section D: Plants

Watch the videos and complete the matching activity.

Video title	QR code
1. Leaf structure	
2. Plant transport: transpiration and translocation	
3. Plant hormones	

1. Leaf structure

Add onto the diagram: palisade mesophyll cell, spongy mesophyll, guard cells, waxy cuticle, upper epidermis, lower epidermis



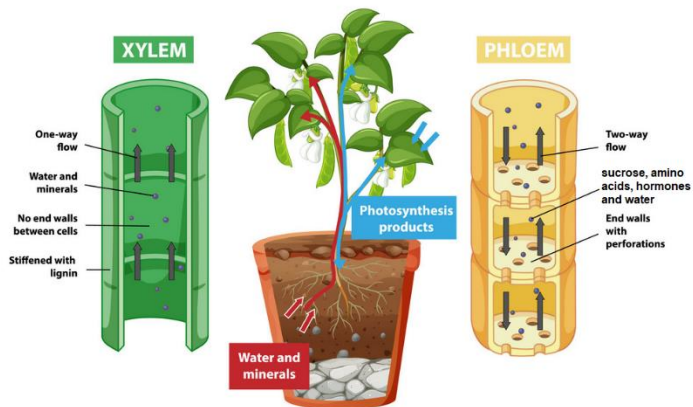
Now add on arrows to show which way the water vapour, carbon dioxide and oxygen move by diffusion through the stomata

Adaptions of leaves:

- Large surface area to absorb more _____ and _____. Chloroplasts contain _____ to absorb the light (most chloroplasts are found in the _____ cells, closer to the upper epidermis). Thin leaves allow _____ to penetrate through cells quickly. Air spaces to allow _____ and _____ to diffuse to/from cells. _____ to provide water. _____ to take away the glucose as _____ to transport to other cells. Leaves are held upright due to _____ and petiole.

2. Plant transport

XYLEM AND PHLOEM



There are 2 types of transport vessels, _____ and _____ for moving molecules around the plant.

In plants sucrose, amino acids and hormones are transported in the _____ vessels by a process called _____

In plants mineral ions are taken up by _____ and water is taken up by _____ in the _____ cells and are transported in the _____ vessels by a process called _____

How the xylem and phloem are adapted to function – decide if each feature is for xylem or phloem

Made of dead cells	Made of living cells
Has companion cells that are alongside the continuous tube	Flows upwards from roots only due to transpiration pull in the leaves
Made of sieve tube elements, which have very little cytoplasm and a few organelles, so more space for fluid to flow	Flows up or down depending on pressure
Contents enter by osmosis	Contents enter tube by active transport
Contains sucrose, amino acids	Contains water and mineral ions
The lignin in cell walls makes the continuous tube waterproof and strong	No cytoplasm or organelles, so more space for fluid to flow
No end walls forming a long tube	Pits (holes) in the walls to allow sideways movement of water eg if a blockage

Make a flow diagram or make notes on the process of transpiration and translation