



Medical Science

Summer Transition Booklet

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Summer Bridging Work: Medical Science Y11 into Y12

Welcome to BTEC National Medical Science AAQ at Slough and Eton

This is a guide to help you get ready for Medical Science. It is aimed to be used after you complete your GCSE throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.

Assessment

Please bring this completed booklet and equipment to your FIRST Medical Science lesson (this could be the first day of school). There will also be a transition test in the second week on all GCSE Biology content, Transition Booklet content and the test will determine your suitability for the course.

Introduction

Medical Science is a big step up from GCSE. In order to prepare for Medical Science, it is vital that you have an excellent understanding of the following concepts, all of which you covered at GCSE and will study in greater depth over the first year of Medical Science:

1. Biological Molecules
2. Cell Structure
3. Organisation in the body
4. Systems within the body
5. Homeostasis

To ensure you have an excellent grounding in each of these topics, please continue to review all GCSE Biology content so that you have a solid foundation to starting Medical Science.

Task -ALL students must complete this

1. Complete the **GCSE prior knowledge quiz** for each of the sections outlined in this booklet.
2. Read through the information provided on **building knowledge** for Medical Science and complete the questions that follow on for each of the **sections** in this booklet. Revise the content, **answer ALL the questions**. You must **print the booklet** and bring it to your first Medical Science lesson.

Preparing for Medical Science Lessons

1. Purchase **A4 lined paper** and a **A4 folder with dividers** and plastic wallets for use in Medical Science Only. You also should have pens, pencil, highlighters, green pen, calculator, ruler etc. Prepare to be fully equipped every lesson.

GCSE to Medical Science Transition Booklet and Quiz

Content:

1) Biological Molecules

- a) Carbohydrates: Starch, Cellulose and Glycogen
- b) Lipids
- c) Proteins and Enzymes
- d) DNA, Energy and Water

2) Cells

- a) Animal Cell Structure and Function
- b) Plant Cell Structure and Function
- c) Diffusion, Osmosis and Active Transport
- d) Immunology

3) Systems in the body

- a) Diffusion and Gas Exchange Surfaces
- b) Circulatory System
- c) Digestive system

4) Genetics

- a) Genetics and Cell Division Key Definitions
- b) Homeostasis

5) Maths Skills and Investigation Skills

- a) References and Variables

This booklet is to help highlight some basic key GCSE knowledge needed to have a good start to the Btec National Medical Science course.

Although other knowledge is required these questions will help determine your basic understanding of biology.

BIOLOGICAL MOLECULES GCSE PRIOR KNOWLEDGE

1) Biological Molecules

- a) Carbohydrates: Starch, Cellulose and Glycogen
- b) Lipids
- c) Proteins and Enzymes
- d) DNA, Energy and Water

Carbohydrates: Starch, Cellulose and Glycogen Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. How may glucose be stored/used by plants? (4)			
2. What is starch made of? (1)			
3. What is the chemical formula for glucose? (1)			
4. Name two reasons starch is important in plants. (2)			
5. Which test is used to see if starch is present? (1)			
6. Which test is used to see if glucose is present? (1)			
7. Describe the method to test for glucose? (3)			

8. Where is cellulose found in a plant cell? (1)			
9. What is the function of cellulose? (1)			
10. Where is glycogen found? (1)			
11. What is the function of glycogen? (1)			
12. How is glycogen made? (2)			
13. What are carbohydrates made of? (1)			
14. What enzyme breaks down carbohydrates? (1)			
TOTAL			/ 20

Carbohydrates Building Knowledge

Three elements make up the carbohydrate molecule – **carbon, hydrogen** and **oxygen**.

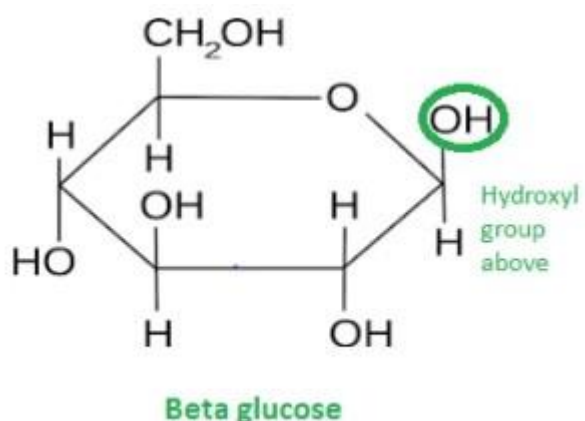
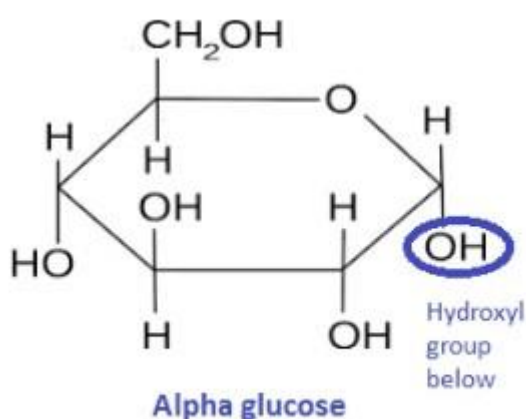
There are several types of carbohydrates;

Sugars

Small, sweet, water soluble molecules. Can be **monosaccharides** (one) or **disaccharides** (two).

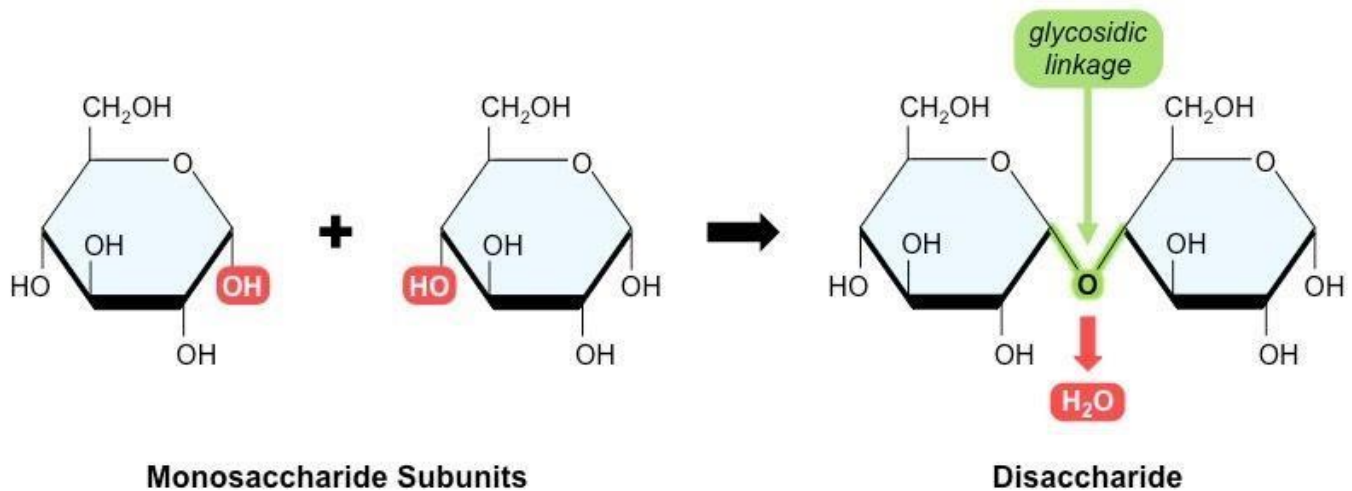
Monosaccharides are single units from which disaccharides are built.

Glucose occurs in 2 forms **alpha (α) glucose** and **beta (β) glucose**.



Glucose and Fructose are monosaccharides and join together to form the disaccharide sucrose.

The joining together of 2 monosaccharides occurs to release a molecule of **water** this is called a **condensation reaction**.

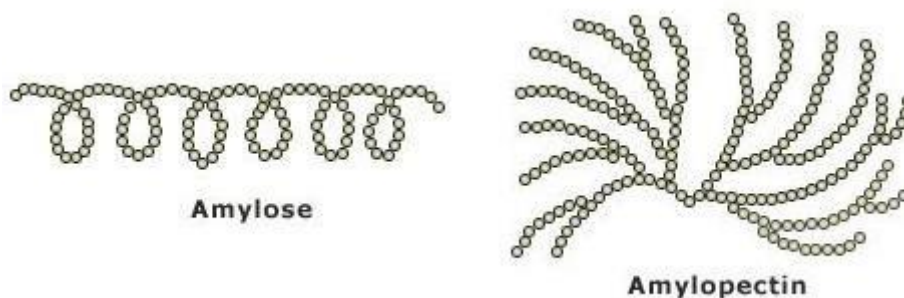


Disaccharides are made from the following monomers:

Glucose + Fructose ⑦ Sucrose + Water
Glucose + Galactose ⑦ Lactose + Water
Glucose + Glucose ⑦ Maltose + Water

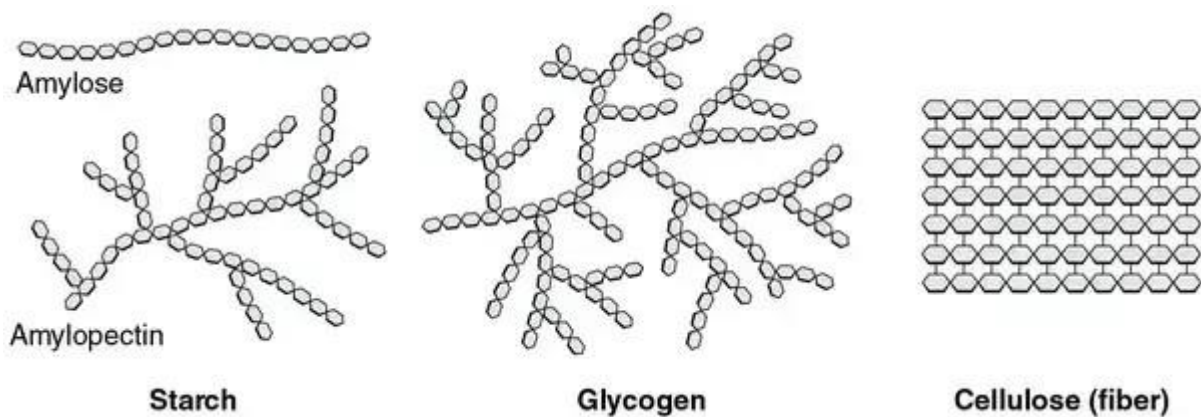
Starch;

A **Polysaccharide** (a large molecule –polymer, made up of monomers). Two different polysaccharides of glucose are used to make **starch- amylose** and **amylopectin**. Starch is insoluble and compact, so it is a good **storage molecule** in plants. Starch is only found in plant cells.



Cellulose;

Polysaccharide; a polymer of glucose. Bonding is different in cellulose; molecules are bonded in a long straight line with weak **hydrogen bonds** between the strands. Several cellulose molecules form microfibrils to provide strength to plant cell walls.



	Cellulose	Starch		Glycogen
		Amylose	Amylopectin	
Source	Plant	Plant	Plant	Animal
Subunit	β -glucose	α -glucose	α -glucose	α -glucose
Bonds	1-4	1-4	1-4 and 1-6	1-4 and 1-6
Branches	No	No	Yes (~per 20 subunits)	Yes (~per 10 subunits)
Diagram				
Shape				

Questions:

1 Name two monosaccharides.

_____ & _____

2 Which disaccharide is composed of two molecules of glucose?

3 Name two polysaccharides.

_____ & _____

Lipids Prior Knowledge

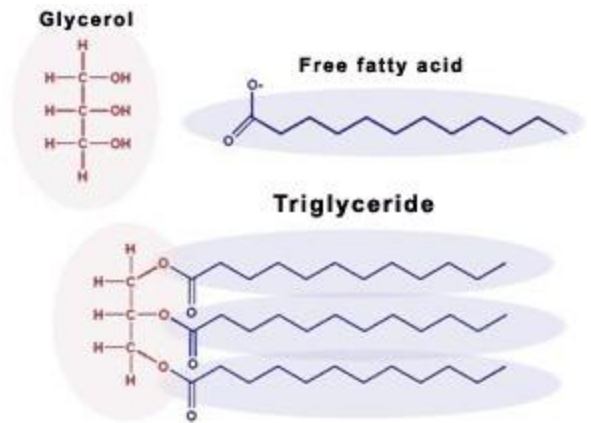
QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. What are Lipids made up of? (1)			
2. What test is used to see if lipids are present? (1)			
3. Describe the method used to test for lipids? (3)			
4. What enzymes are used to break down lipids? (1)			
5. State 3 functions of lipids in the body (3)			
6. Name 2 foods high in lipids? (1)			
7. What disease is caused when large amounts of lipids are store (1)			
TOTAL		/ 11	

Lipids Building Knowledge

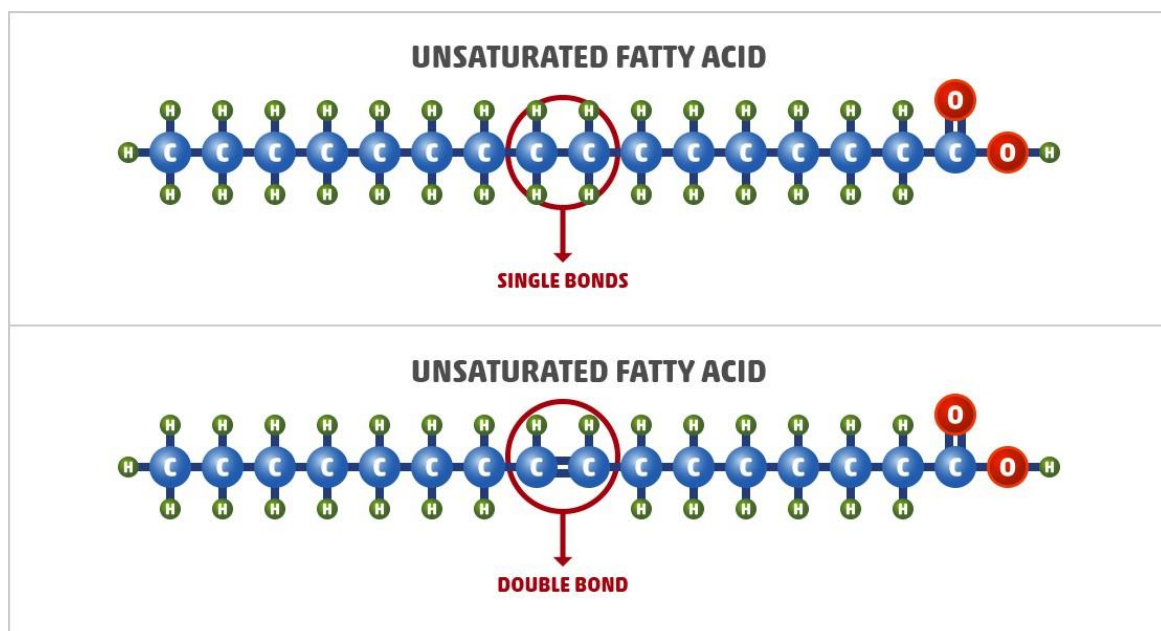
Lipids;

Three elements make up the lipid molecule – **carbon, hydrogen** and **oxygen**.

Lipids are fats and oils, predominantly made up of a group of lipids called **triglycerides**. These contain a molecule of **Glycerol** with **3 fatty acids**.



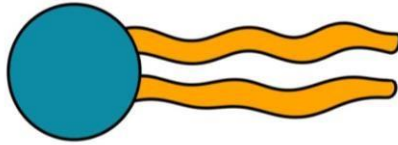
The **fatty acid** is a long chain of **Carbon** atoms with a carboxylic acid (**-COOH**) group on one end. **Hydrogen** atoms are attached to the Carbons by single bond. A single bond forms a **saturated** lipid. If there is a double bond then the lipid is **unsaturated**, many double bonds form a polyunsaturated lipid.



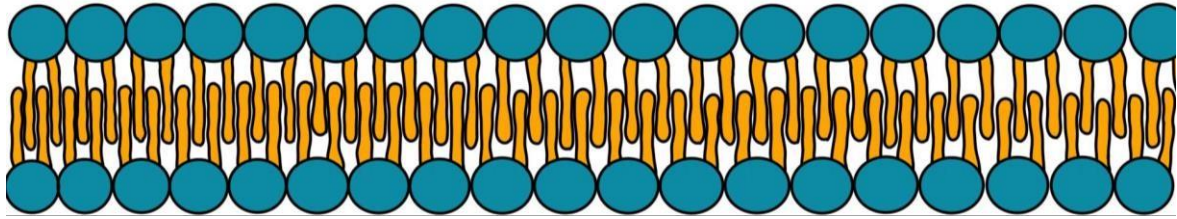
Phospholipids

Cell membranes are formed from two layers of **phospholipids**. They do not have 3 fatty acid chains but **2 fatty acid** chains and a **phosphate** group.

Phospholipids make up the cell membrane.
Each phospholipid consists of a phosphate head linked to 2 fatty acid chains.



The head is hydrophilic and interacts with water. The tails are hydrophobic and hate water.
Phospholipids create two layers to make the cell's double membrane.



Questions:

1 Which elements are fatty acids composed of?

2 What is the difference between saturated and unsaturated fatty acids?

3 How are triglycerides different to phospholipids?

Proteins and Enzymes Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. What are proteins made up of? (1)			
2. What test is used to see if protein is present? (1)			
3. Describe the method used to test for proteins? (3)			
4. What are proteins needed for? (4)			
5. Define enzyme (2)			
6. What are enzymes made of? (1)			
7. Name 3 factors that affect the rate an enzyme works? (3)			
8. What happens to an enzyme is the temperature is too low? (1)			
9. What happens to an enzyme if the temperature is too high? (1)			
10. Define the answer to question 7 (1)			
11. State 3 processes in the human body enzymes where are needed (3)			
TOTAL			/ 21

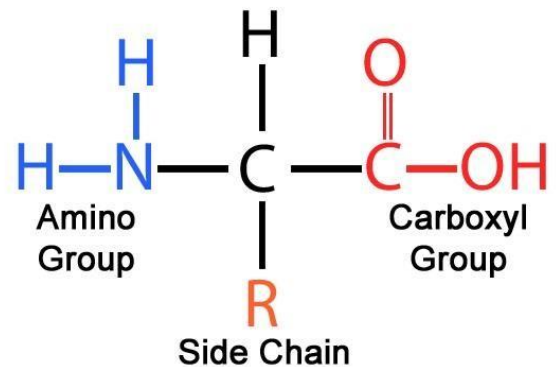
Proteins and Enzymes Building Knowledge

Proteins

Proteins are made of long chains of **amino acids**, up to several hundred long. There are only 20 different amino acids and the combination of these 20 produce a wide range of complex proteins.

Protein structures are held together with strong bonds called **Peptide bonds**. The order of the amino acids determines the structure and how it works.

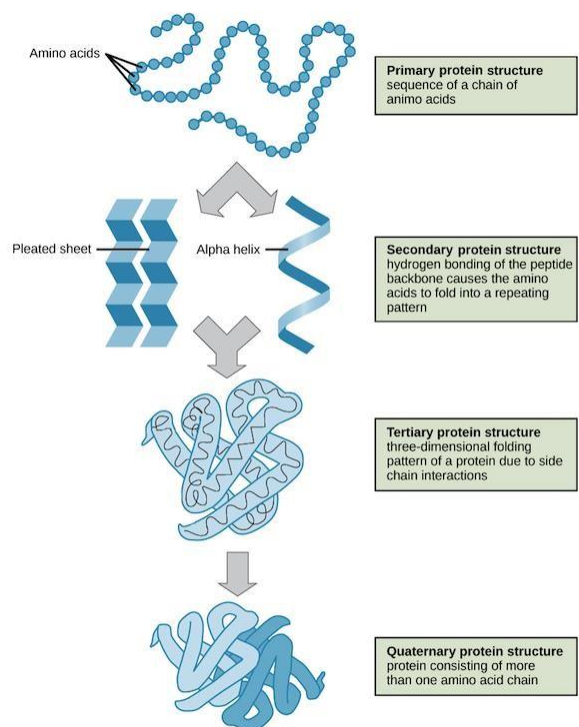
All amino acids have the same general structure however with a different **R group**. They contain; **Hydrogen, Oxygen, Nitrogen** and **Carbon**.



Proteins structure

PRIMARY STRUCTURE

The order of the amino acids that are held together by **peptide bonds** into a **polypeptide chain**.



SECONDARY STRUCTURE

The polypeptide (protein) chain can then **coil** or **fold into pleats** which are held together by weak **hydrogen bonds**.

TERTIARY STRUCTURE

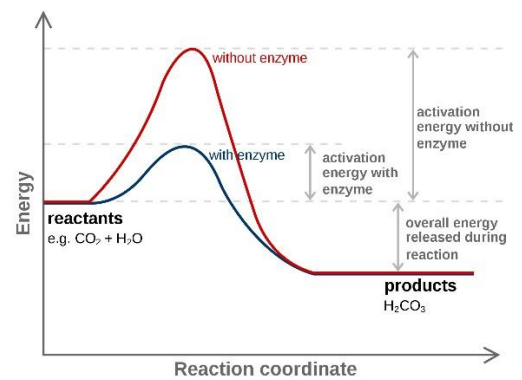
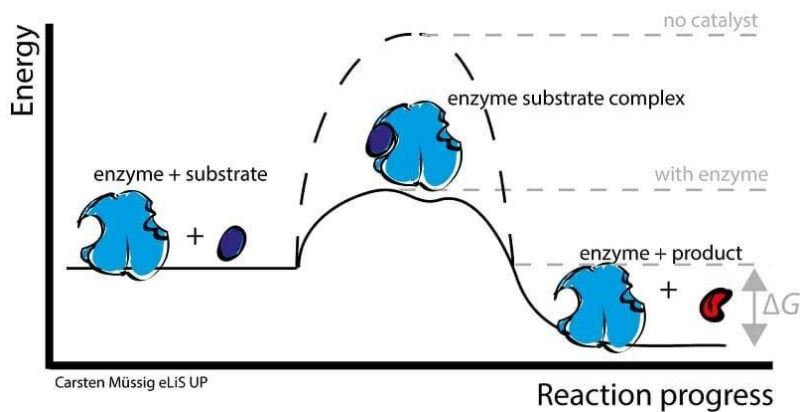
Enzymes have a further folding held together with hydrogen bonds as well as stronger **ionic bonds and disulphide bonds**. If the structure is almost spherical it is called a **globular protein**.

Enzymes

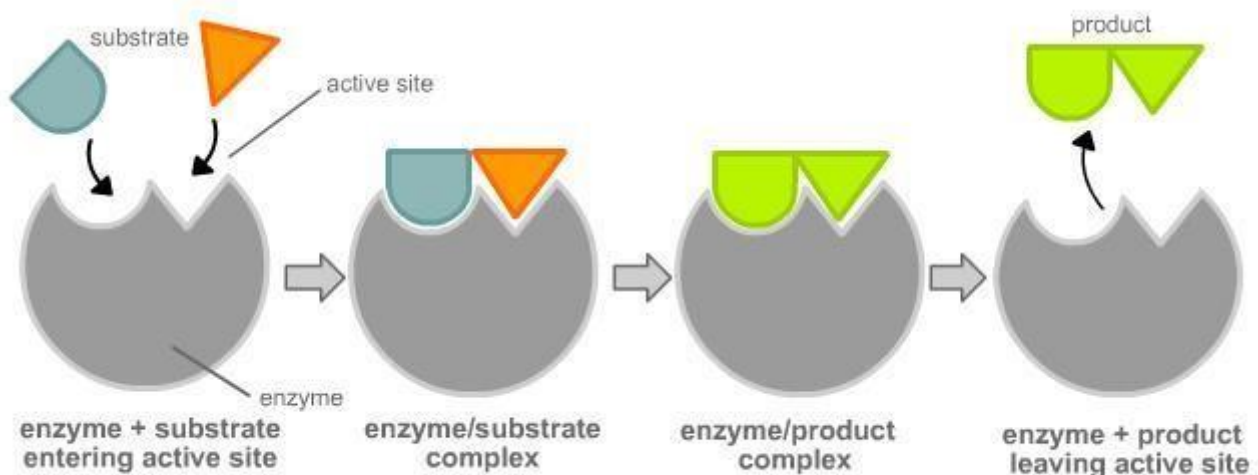
Speed up biochemical reactions.

Metabolism is the sum of all the biochemical reactions that occur per second and a single chain of these reactions is called a **metabolic pathway**.

Enzymes are **biological catalysts** and **increase** the **rate** of reactions. Reactions that release energy need an input energy to start. The input energy is called the **ACTIVATION ENERGY**. Enzymes lower the activation energy.



Enzymes are proteins; enzymes are **globular proteins** with a specific order of amino acids that determines what the enzyme does. Enzymes can be **catabolic** (break substrates down) or **anabolic** (build substrates up). Enzymes have a specific site called the **active site** into which the **substrates** can attach itself. The active site is **complementary** to the shape of the substrate. Once attached, they form the **enzyme-substrate complex**. The substrate then breaks bonds or makes bonds (depending on the type of enzyme) and the **product** leaves the active site. The active site is now able to accept another substrate. Enzymes are not used up in the reaction.



Denaturing enzymes; Enzymes have a specific tertiary shape held in place by weak hydrogen bonds and stronger disulphide bonds. These bonds can be broken by an increase in temperature (kinetic energy) or a change in pH (H^+ in acid or OH^- in alkali disrupt the bonds).

Useful enzymes; Digestive enzymes are catabolic, breaking down food into smaller molecules. Enzymes are also needed in DNA replication, building up molecules (DNA polymerase).

Questions:

1 What is the primary structure of a protein? Draw a labelled diagram of the monomer.

Labelled Diagram:

2 What type of bonding is present in the secondary and tertiary structure of a protein?

Secondary Structure: _____

Tertiary Structure: _____

3 What is the role of enzymes?

4 What is activation energy?

5 What is the role of digestive enzymes?

DNA, Energy and Water Prior Knowledge

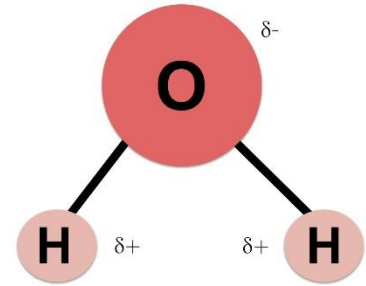
QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. What does DNA stand for? (1)			
2. Describe the structure of DNA (2)			
3. Where is DNA found in a prokaryotic cell? (1)			
4. Where is DNA found in a eukaryotic cell? (1)			
5. What is the function of DNA? (1)			
6. What process is used to provide cells with energy? (1)			
7. Write the balanced symbol equation for aerobic respiration (2)			
8. Where does aerobic respiration take place? (1)			
9. Where does anaerobic respiration take place? (1)			
10. Name 4 way energy can be transferred in a cell (4)			
11. How many elements and atoms are present in a water molecule? (2)			
12. Draw the structure of water (2)			
13. State 3 ways your body losses water (3)			
TOTAL			/ 22

DNA, Energy and Water Building Knowledge

Water

Water is a **polar molecule** with partially positive charges on the Hydrogens and a partially negative charge on the Oxygen.

Water is an excellent **solvent** which means it can dissolve many polar and ionic substances.



Questions:

1 What charge do each of the elements on a water molecule have?

DNA and protein synthesis

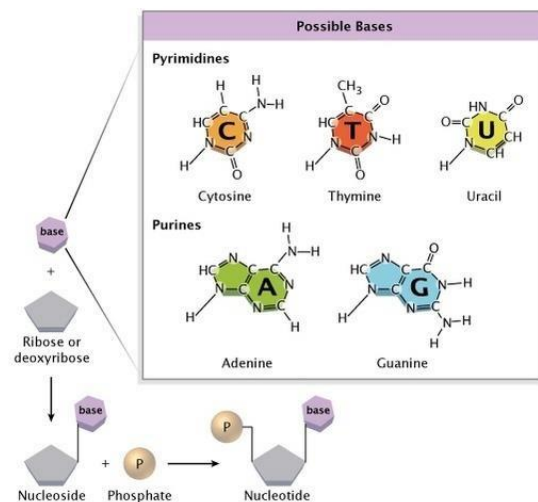
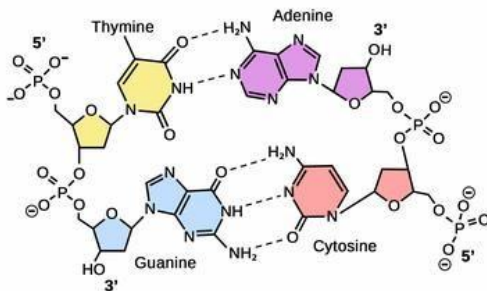
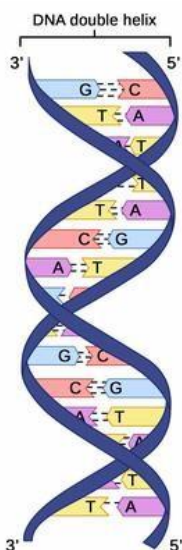
DNA is a complex chemical, found in the nucleus of eukaryotes and in the cytoplasm of prokaryotes. DNA is made up of; **pentose sugar, phosphate and nitrogenous bases** forming a **NUCLEOTIDE**.

There are 4 different nitrogenous bases;

A= Adenine T= Thymine C= Cytosine G= Guanine

Complementary pair;

A pairs with T C pairs with G

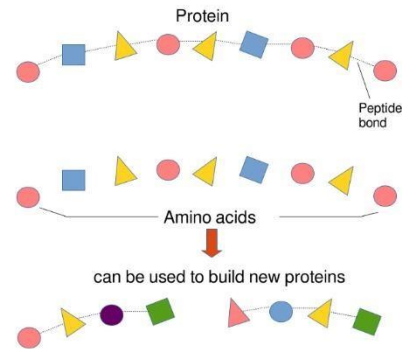


The bases pair up in the formation stated above. They are held together by **hydrogen bonds**. The two strands run in opposite directions causing the molecule to spiral forming a **DOUBLE HELIX**.

DNA controls the production of proteins. A section of DNA that codes for a protein is called a **gene**.

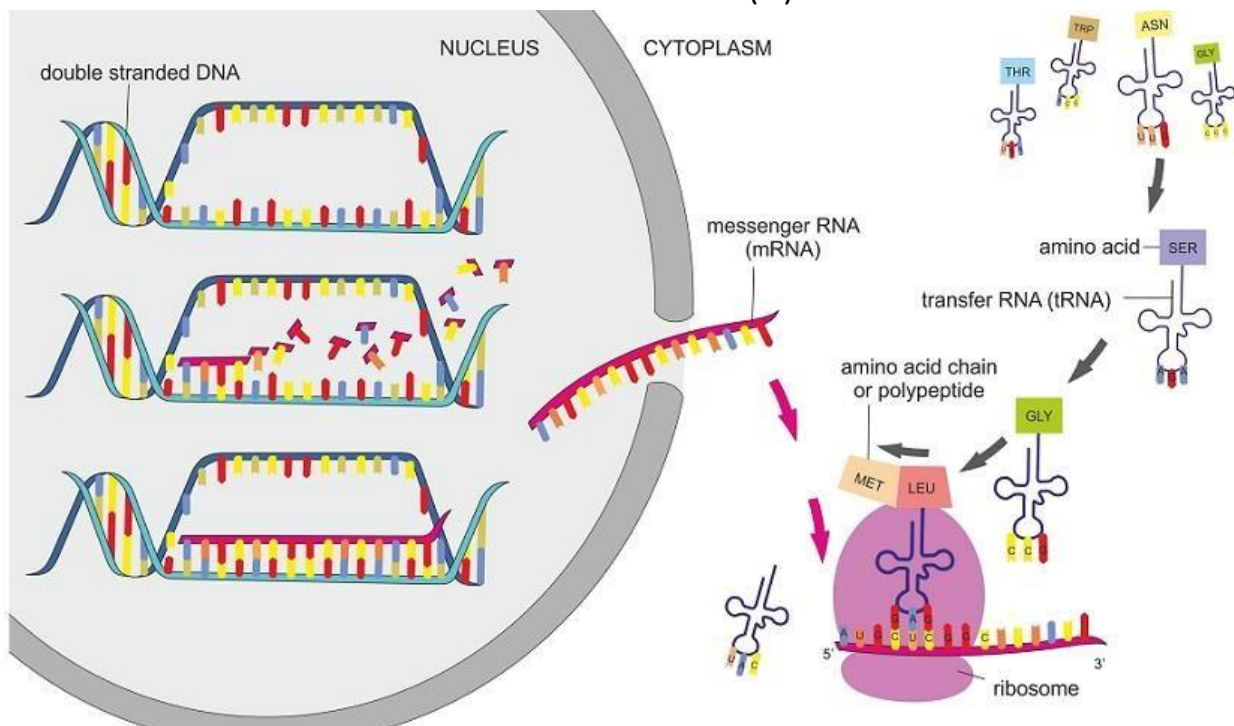
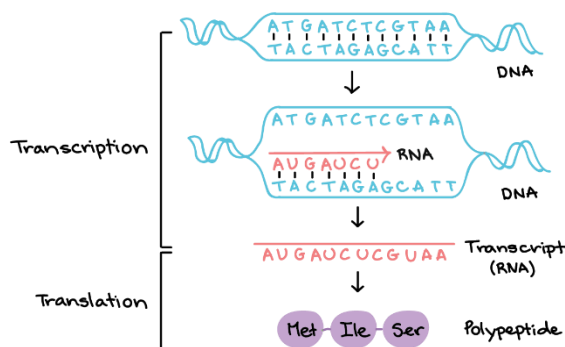
Proteins are made up of a string of **amino acids**, each protein has a different number and order of amino acids. The proteins also have different bonds which holds the molecule in a unique shape which means all proteins have a different function.

Chain formation of amino acids in proteins



Protein synthesis:

Protein synthesis occurs in the cytoplasm, carried out by **RIBOSOMES**. When a protein is required then the gene has to be copied producing a molecule called **messengerRNA** (mRNA). mRNA is small enough to pass out of the nucleus into the cytoplasm. mRNA is a template, containing nucleotides and bases. The nucleotide on the mRNA will line up with the **complementary base**. However, on RNA there is no Thymine, RNA will have the base **URACIL (U)**.



The mRNA passes out of the nucleus carrying the code for a protein. Once in the cytoplasm the mRNA binds to a ribosome.

Within the cytoplasm there is another molecule called transferRNA (tRNA). At one end, the **anticodon** is complementary to the mRNA.

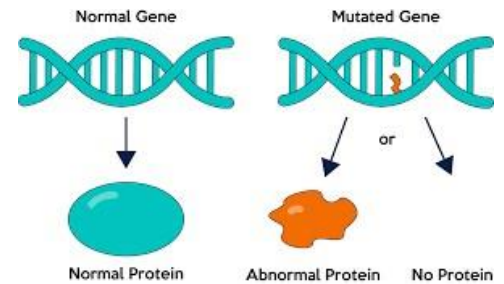
At the opposite end there are three **unpaired bases** which code for an **amino acid**. The amino acid is brought in to form a **peptide bond** with the amino acids brought in by the previous tRNA. This forms a **polypeptide** chain which will form hydrogen and **ionic** and disulphide **bonds** to form the unique protein.

Mutations:

Mutations change the order of bases in the DNA. Some bases may change to a different base (**substitution**), some bases may be deleted and some bases may be added.

Mutations can cause the following:

- Incorrect protein to be produced
- No change in protein being made
- Causes a harmful protein/ no protein to be made



Questions:

1 What are the components of a nucleotide?

2 What are the four nitrogenous bases?

3 What is the name given to the double-stranded structure of DNA?

4 What is the name of a section of DNA that codes for a protein?

5 What are proteins made from?

6 What molecule contains the information from the DNA and is able to leave the nucleus?

7 What organelle will this molecule attach to in the cytoplasm?

8 Which molecule has a complementary anticodon and brings in the correct amino acid?

CELLS GCSE PRIOR KNOWLEDGE

2) Cells

- a) Animal Cell Structure and Function
- b) Plant Cell Structure and Function
- c) Diffusion, Osmosis and Active Transport
- d) Immunology

Animal Cell Structure and Function Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. What are the 5 most common structures in an animal cell? (5)			
2. Describe the function of each of those 5 structures? (5)			
3. List 3 specialised animal cells (3)			
4. How many mm in a cm? (1)			
5. How many μm in a mm? (1)			
6. What equation links magnification, size of real object and size of image? (1)			

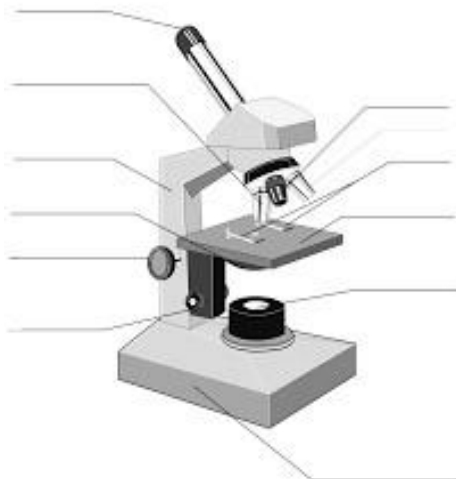
7. State 2 differences between electron microscope and a light microscope? (2)			
TOTAL			/ 18

Animal Cell Structure and Function Building Knowledge

Microscopes;

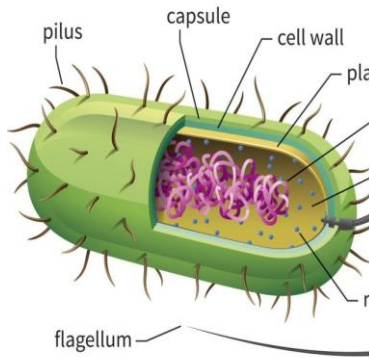
The Light microscope allows you to view animal cells. It can magnify up to 1500 times. Some organelles such as mitochondria, chloroplasts, vacuoles, cell walls, cell membranes and nuclei are visible. Staining makes these organelles visible.

Label and annotate the diagram:



The electron microscope; invented in 1950s it allows a much higher magnification (500 000x) and better resolution, allowing greater detail to be seen. Electron microscopes allowed detailed ultrastructure of the cell to be seen, such as ribosomes and the inside of mitochondria and chloroplasts.

Prokaryotes; A bacterial cell is a prokaryotic cell. It is a single celled organism.



Prokaryotes like bacteria are roughly a **tenth the size** of eukaryotic cells.

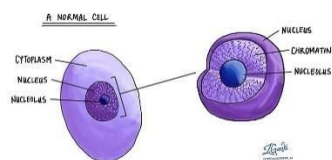
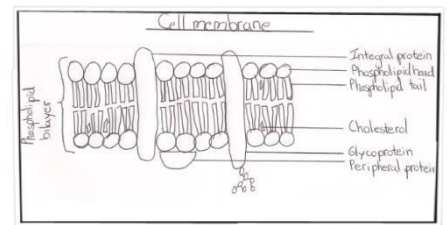
Prokaryotic cells **don't** contain a nucleus, mitochondria or chloroplasts.

Some prokaryotes have a **rings of DNA** called **plasmids**.

Eukaryote Animal Cell

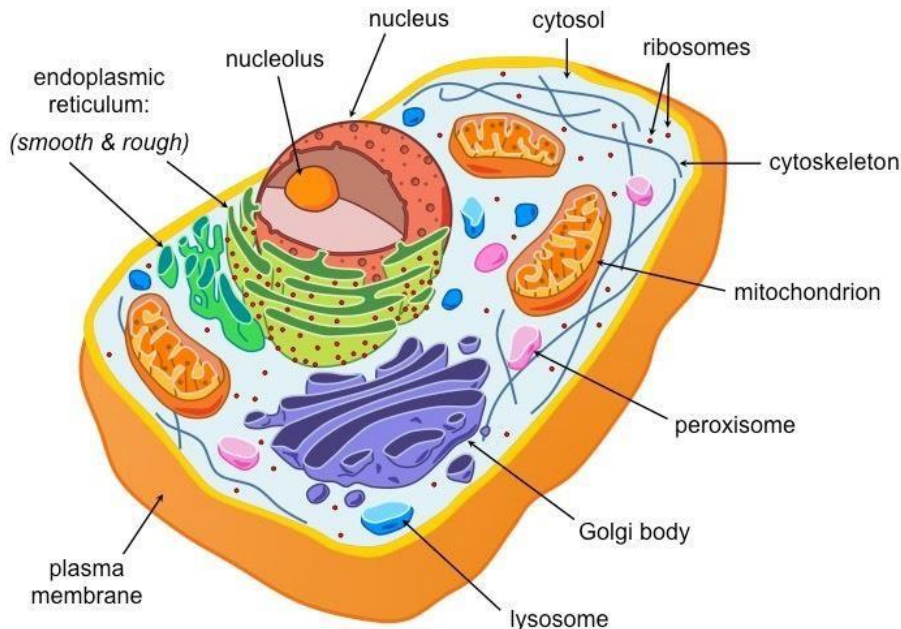
Cell structures

Cell surface membrane: Found around every cell, it allows the movement of substances into and out of the cell. It is a partially permeable membrane and will prevent certain substances from entering. It is made up of a double layer called the **PHOSPHOLIPID BILAYER**. These are molecules closely packed together in a mosaic pattern. Within the bilayer are large proteins which are also responsible for transport and for cell recognition.



Nuclei: controls the cell function, containing the DNA which is the coded information for the production of proteins. During cell division the chromosomes become shorter and thicker and can be seen with a light microscope. The chromosomes will then make a copy of themselves, one copy for each cell produced during cytokinesis. Nuclei have a double membrane called the nuclear envelope.

Mitochondria: can be seen with a light microscope, however, greater internal detail can be seen using an electron microscope. The mitochondria's function is to carry out aerobic respiration. The energy released is used to form molecules of ATP. ATP is used in the cells to provide energy for muscular contractions, active transport as well as anabolic and catabolic reactions.



Challenge:

Can you find out about the structure and function of the other organelles labelled on the diagram?

Plant Cell Structure and Function Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. State the 3 structures found in plant cells but not animal cells? (3)			
2. State the function of these 3 structures (3)			
3. What are cell walls made of? (1)			
4. What is the permanent vacuole filled with? (1)			
5. State 3 specialised plant cells (3)			

6. Name 4 tissues found in a leaf (4)			
7. Explain the roles of the 4 tissues found in a leaf (4)			
TOTAL			/ 19

Diffusion, Osmosis and Active Transport Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. Define diffusion (1)			
2. Define osmosis (1)			
3. Define active transport (1)			
4. What is the main difference between diffusion and osmosis? (1)			
5. What are the 2 main differences between active transport and the other 2? (2)			
6. State and describe where in a plant Active Transport occurs (2)			

7. State and describe where in an animal Diffusion will occur? (2)			
8. State and describe where in an animal osmosis will occur? (2)			
9. State and explain 3 factor that can change the rate of diffusion (6)			
10. Put these 500 ml sucrose concentrations in order of water concentration from highest to lowest. 20%, 0%, 45%, 10% and 15%(1)			
TOTAL			/ 19

Diffusion, Osmosis and Active Transport Building Knowledge

Transport into and out of cells

There are 4 modes of transport you need to be aware of:

Diffusion; can be gas or liquid particles. They move from an area of high concentration to an area of low concentration down a concentration gradient. Small molecules such as oxygen, water and carbon dioxide can pass through the phospholipid bilayer. **NO ENERGY IS REQUIRED.**

Osmosis; occurs only with water. The water particles move from an area of high water concentration to an area of low water concentration, down a concentration gradient, across a partially permeable membrane. **NO ENERGY IS REQUIRED.** You will be required to refer to water potential in AS level not water concentration.

Facilitated diffusion; Some particles are too large to fit through the phospholipid bilayer and therefore require a carrier protein to assist. The protein carriers are within the bilayer, and they change shape when they come into contact with a specific molecule (i.e. Glucose). **NO ENERGY IS REQUIRED.**

Active transport; This moves substances for an area of low concentration to an area of high concentration against a concentration gradient. **ENERGY IS NEEDED** for this to occur. Specific carrier proteins are also required these can be called pumps.

Questions:

1 What do you call the diffusion of water molecules through the cell membrane?

2 Give another term for the concentration of water molecules.

3 Name the two types of protein involved in facilitated diffusion.

4 Why does active transport require energy?

Disease and Immunology Building Knowledge

Disease

Pathogens are microorganism that can cause diseases. **Infectious diseases** can be passed on from person to person, for example TB, malaria, HIV.

Some diseases can be caused by **genetic defects** known as **mutations** in a person's genes, example includes cystic fibrosis.

Lifestyle choices can also **increase the risk** of getting certain diseases, for example smoking

Risk factor	Diseases
Smoking	Mouth, lung and throat cancer, emphysema and other lung diseases, cardiovascular disease
Drinking too much alcohol	Mouth, stomach, liver and breast cancer, possibly many other cancers, cardiovascular disease
High blood pressure	Cardiovascular disease, diabetes
Overweight/obese	Various cancers, cardiovascular disease, diabetes
Unbalanced diet	Various cancers, cardiovascular disease, diabetes
Using sun beds too much	Skin cancer

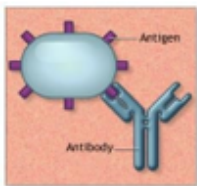
increases the chances of obtaining lung cancer.

Risk factors are things that **increase the chances** of something negative taking place, although they don't always lead to a disease. Some risk factors are unavoidable because they are inherited, however some are associated with lifestyle choices and hence avoidable.

Immunity

Phagocytes are a type of white blood cells that **engulf** pathogens carrying foreign antigens and destroying them.

Antigens are molecules on the surface of a pathogen that marks it as foreign to the body. All cells including human cells contain antigens on their surfaces.



There are different types of white blood cells.

B-cells also known as **B-lymphocytes** are white blood cells that **produce antibodies** that bind to antigens. An antibody binding to the antigen brings about the death of the pathogen carrying it.

T-cells or **T-lymphocytes** are white blood cells that communicate between phagocytes and B-cells. When a phagocyte engulfs a pathogen, it signals to the T-cells that a foreign object has been found. The T-cell then **activates** the B-cells to produce antibodies.

Vaccinations

If your **vaccinated** against a pathogen, you have **immunity** against it. This means that you can no longer get that disease. Vaccines **contain antigens** from inactivated or dead pathogens.

You body then produces **antibodies** against the antigens so if the same pathogen tries to enter or invade, the immune system can **respond rapidly** preventing you from getting the **symptoms**.

Vaccines don't stop the pathogen from entering the body, however they **get rid of it** very quickly once it does enter.

Questions:

1 Give an example of an infectious disease.

2 What is a risk factor?

3 List two diseases that obesity is a risk factor for.

4 What do phagocytes detect?

5 What kind of white blood cells produce antibodies?

6 What is the role of T-cells?

7 What do vaccines contain?

Understanding Bacteria Growth and Aseptic Technique

Instructions

This worksheet will guide you through the concepts related to bacteria multiplication, growth conditions, and aseptic techniques used in laboratory settings. Complete each section, making sure to think critically about the processes involved.

Background Reading

Bacteria are single-celled microorganisms that can reproduce rapidly by a process called binary fission, where one bacterium splits into two. Under ideal conditions with sufficient nutrients and suitable temperatures, some bacteria can divide as often as every 20 minutes. Bacteria can be cultured in a nutrient broth solution or on agar gel plates, where they form colonies. Aseptic technique is critical for preparing uncontaminated cultures, which ensures that investigations into the effects of disinfectants and antibiotics are accurate. This includes sterilising petri dishes and culture media before use, as well as the inoculating loops used to transfer bacteria. The lid of the Petri dish should be secured to prevent contamination, and it is essential to incubate cultures at 25°C in school laboratories to limit the growth of potentially harmful pathogens.

Activities

Activity 1: Binary Fission Calculation

1. Research how bacteria multiply through binary fission, including diagrams that depict this process.
2. Using the mean division time of 20 minutes, calculate the number of bacteria present after 1 hour if you start with 1 bacterium.
 - Formula: $(N = N_0 \times 2^{(t/T_d)})$ where $(N_0$ is the initial quantity, (t) is the total time in minutes, and $(T_d$ is the mean division time.

Initial Bacteria (N_0): 1

Total Time (t): 60 minutes

Mean Division Time (T_d): 20 minutes

Calculated Number of Bacteria (N): _____

Activity 2: Aseptic Technique

1. Describe how to prepare an uncontaminated culture using aseptic techniques, incorporating a diagram that illustrates these practices.

-
1. Explain the importance of the following aseptic techniques:

- Why must Petri dishes and culture media be sterilised before use?

-
- Why must inoculating loops be sterilised by passing them through a flame?
-

- Why should the lid of the Petri dish be secured with adhesive tape and stored upside down?

-
- Why are cultures generally incubated at 25°C in school laboratories?

Activity 3: Cross-sectional Area Calculation

1. If a bacterial colony has a radius of 3 cm, calculate the cross-sectional area using ($A = \pi r^2$).

Radius (r): 3 cm

Calculated Area (A): ____ cm²

Questions

1. After 3 hours, how many bacteria would be present if starting from 1 bacterium?
2. If you have a zone of inhibition diameter of 4 cm around antibiotic X, calculate the radius and the area of this zone of inhibition.

Zone of inhibition radius (r): ____ cm

Calculated Area (A): ____ cm²

3. Express the calculated number of bacteria after 3 hours in standard form.

MEDICAL SCIENCE TRANSITION WORKSHEET

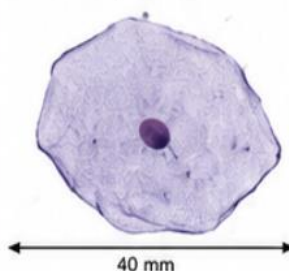
Name: _____

Date: _____

Read each scenario carefully and answer the questions.

A. MAGNIFICATION

Amira is looking at cheek cells under a microscope. She takes a photo of one cell.



The actual size of the cell is 20 μm .

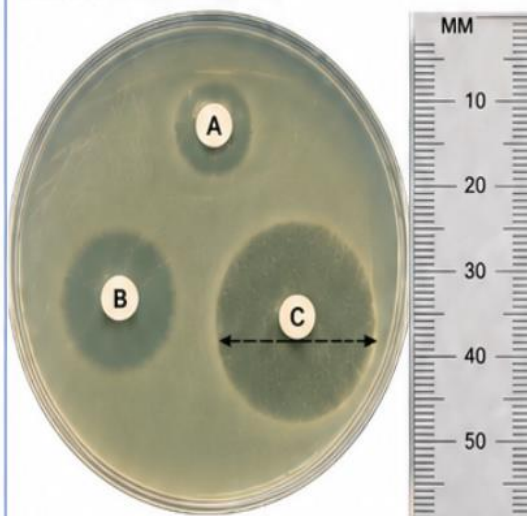
$$\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}$$

- Calculate the magnification of the cell.
Answer: _____
- A bacteria in another image measures 15 mm. Its actual size is 3 μm . Calculate the magnification.
Answer: _____
- An image has a magnification of $\times 750$. The actual size of the object is 5 μm . Calculate the image size in mm.
Answer: _____

Remember to convert all units to the same unit before calculating.

B. ZONES OF INHIBITION

A student is investigating how effective three different antibiotics are against a strain of bacteria. After incubation, the zones of inhibition are measured in millimetres (mm).



- Measure the diameter of each zone of inhibition in mm. Give your answers to the nearest mm.
A = _____ mm
B = _____ mm
C = _____ mm

- Which antibiotic was the most effective?
Answer: _____
- Which antibiotic was the least effective?
Answer: _____
- Explain your answers using data.

C. MEANS AND ANOMALIES

A student tested the same antibiotic three more times. The zones of inhibition (mm) recorded were:

11	12	11	26
----	----	----	----

- Calculate the mean including all results.
Answer: _____
- Which result is anomalous?
Answer: _____
- Explain why this result may be anomalous.

- Calculate the mean again without the anomalous result.
Answer: _____

D. CHOOSING THE CORRECT GRAPH

Choose the most suitable type of graph for each scenario. Write Bar Chart, Line Graph or Scatter Graph.

- Comparing the effectiveness of two different mouthwashes on bacterial growth.
Answer: _____
- Measuring heart rate of a person every minute during 10 minutes of exercise.
Answer: _____
- Investigating the relationship between age and resting blood pressure.
Answer: _____
- Comparing the number of white blood cells in four different patients.
Answer: _____

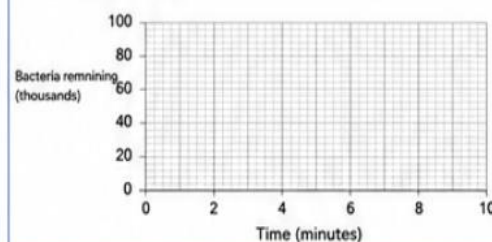
E. GRAPH SKILLS

The table below shows the number of bacteria (in thousands) remaining after being exposed to an antiseptic for different lengths of time.

Time (minutes)	0	2	4	6	8	10
Bacteria remaining (thousands)	100	80	50	25	12	5

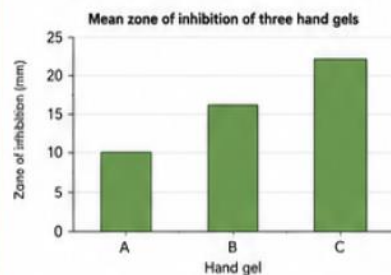
- Draw a suitable graph to show this data on the grid below. Remember to include:

- a title
- a labelled x-axis with units
- an appropriate scale
- a line or best fit



F. SCIENTIFIC CONCLUSIONS

A student tested three hand gels (A, B and C). The mean zones of inhibition (mm) were:



Write a scientific conclusion about which hand gel is the most effective. Use evidence from the graph.

G. EVALUATING INVESTIGATIONS

A student investigated how temperature affects the activity of an enzyme.

1. Define the following terms.

a) Reliability: _____

b) Validity: _____

c) Accuracy: _____

2. Suggest one way the student could improve the reliability of their investigation.

3. Suggest one way the student could improve the validity of their investigation.

H. UNIT CONVERSIONS

Convert the following into the units shown.

1. 3.5 cm = _____ mm

2. 2 mm = _____ μ m

3. 750 μ m = _____ mm

4. 850 mL = _____ L

5. 2.4 L = _____ mL

6. 45 mm = _____ cm

7. 0.25 L = _____ mL

8. 6000 μ m = _____ mm

CHALLENGE SCENARIO – APPLY YOUR SKILLS

A student compared four different disinfectants (D1, D2, D3 and D4) against the same bacteria.

Each disinfectant was tested three times.

The results (zone of inhibition in mm) were:

D1	D2	D3	D4
10	14	22	18
11	13	20	17
9	15	21	19

1. Calculate the mean zone of inhibition for each disinfectant.

D1 = _____ mm D2 = _____ mm D3 = _____ mm D4 = _____ mm

2. Which disinfectant was the most effective? _____

3. Which disinfectant was the least effective? _____

4. Draw a bar chart to compare the mean zones of inhibition.

5. Write a scientific conclusion using evidence from your results.

6. Suggest one improvement to this investigation.



TOP TIP: Always show your working, use correct units, and write full sentences for your conclusions.

Systems within the body GCSE PRIOR KNOWLEDGE

3) Systems within the body

- a) Diffusion and Gas Exchange Surfaces
- b) Circulatory System
- c) Digestive System

Diffusion and Gas Exchange Surfaces Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. Define diffusion (1)			
2. State 4 ways how the rate of diffusion is increased in the alveoli (4)			
3. Explain how the 3 ways stated in question 2 speed up the rate of diffusion. (3)			
4. Explain how capillaries are efficient for diffusion (2)			
5. What is facilitated diffusion? (1)			
6. Give 2 example in animals where diffusion is needed (2)			

7. Give 2 examples in plants where diffusion is needed (2)			
8. State 3 ways the small intestine is sufficient for diffusion (3)			
9. Explain the 3 ways the small intestine is sufficient for diffusion (3)			
TOTAL / 21			

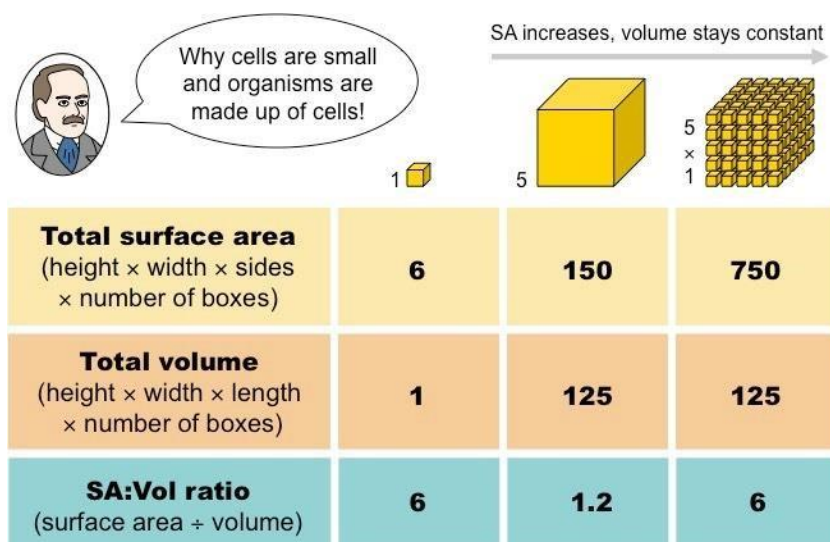
Diffusion and Gas Exchange Surfaces Building Knowledge

Exchange surfaces

All good exchange surfaces require adaptations to make the exchange efficient.

The **smaller the object**, the quicker exchange is able to occur due to it having a **large surface area to volume ratio**, however larger, more complex organisms have a much smaller surface area to volume ratio.

The larger the object, the lower the surface area to volume ratio.



To overcome this, multicellular organisms have highly adapted exchange organs.

Adaptations include:

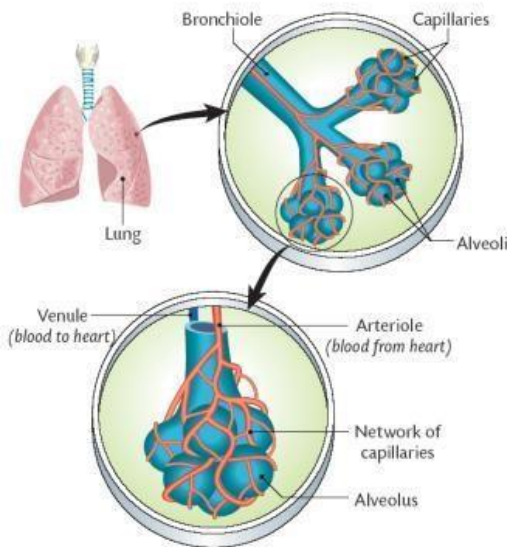
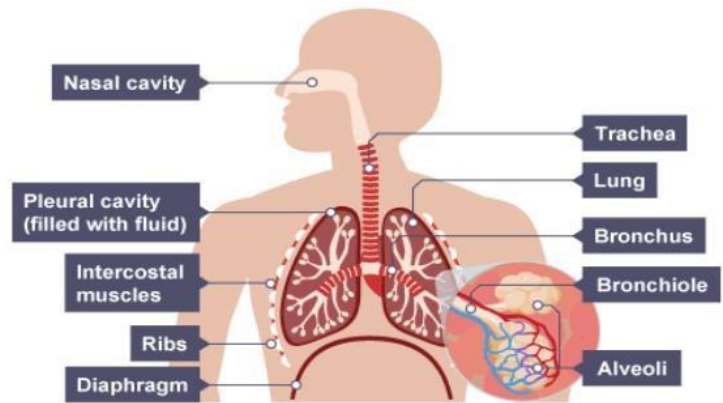
- Folded to increase the surface area to volume ratio for a faster exchange.
- A good blood supply to maintain the concentration gradient.
- One cell thick (thin) to reduce diffusion distance.

Materials that need to be exchanged between the cell and the environment include heat, oxygen, water, carbon dioxide, nutrients, and other waste products such as urea. The **adaptations allow MORE** substances to be exchanged at a **faster** rate.

Gas exchange in Animals

Lungs;

Multicellular organisms have evolved a **complex blood supply system** and a large gas exchange system (**lungs**). The lungs contain millions of tiny air sacs called **ALVEOLI** which are then folded to further increase the surface area of the lung.



The **alveoli** are further adapted by having a **single flattened layer of epithelial squamous cells** which **shortens the diffusion distance** increasing the speed of diffusion.

Alveoli have a dense **network of capillaries** to move the blood away quickly, maintaining a **steep diffusion gradient**.

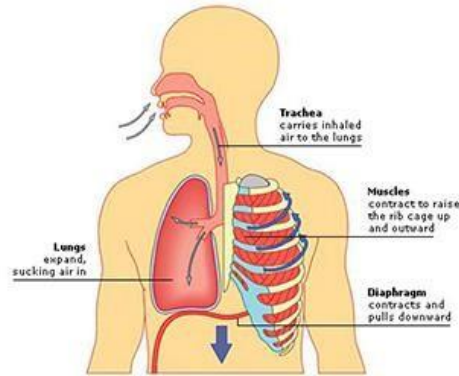
The walls of the alveoli are **fully permeable** to dissolved oxygen and carbon dioxide.

Breathing - Ventilation

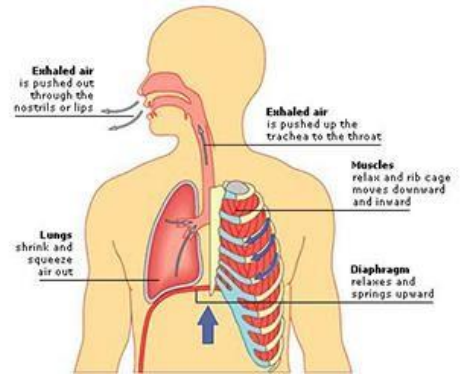
The process of maintaining a high concentration of oxygen inside the lungs and getting rid of the waste product carbon dioxide. Ventilation increases the rate of diffusion. Lungs are suspended in the airtight Thorax and any change in volume will affect the pressure in the thorax.

Inhalation and Exhalation

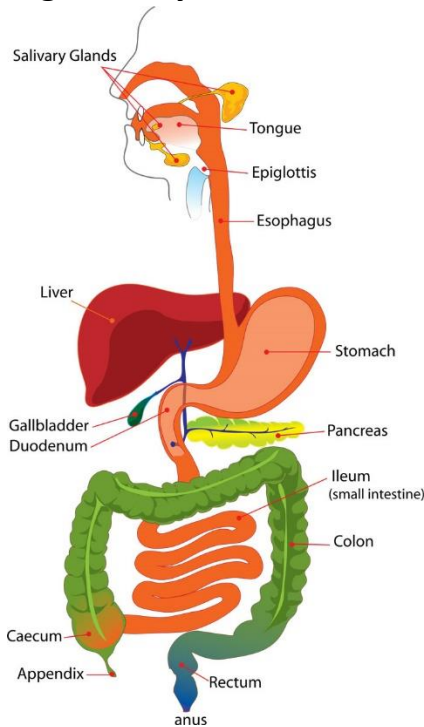
- Intercostal muscles contract, lifting rib cage up and out
- Diaphragm contracts and pulls downward
- The lungs expand, air is sucked in



- Intercostal muscles relax
- Diaphragm relaxes
- The ribs fall downward and inward
- Diaphragm back into dome shape, squeezing lungs and pushing air out



Digestive system



Mechanical and chemical digestion

Teeth break down food in the mouth mechanically, this means they grind it up. Chemical digestion occurs when enzymes digest food into nutrients.

Bile is produced by your liver and stored in the gall bladder. This is released into the small intestine to break down large molecules of lipids into smaller ones. This is not digestion because it doesn't break down lipids into nutrients, just smaller droplets. This is called *emulsification* and increases the surface area for enzymes to act upon.

Moving food through the digestive system

Digested food is moved through the oesophagus, and small and large intestines by muscles in their linings that squeeze it along in a process called *peristalsis*.

Absorbing food and water

The intestines have lots of tiny folds in them which create a large surface area for absorbing nutrients and water. In the small intestine there are also specialised structures called villi which have a tiny hair-like structure poking into the small intestine to absorb digested food.

Questions:

1 An animal has a surface area of 7.5cm^2 and a volume of 1cm^3 . What is the SA:V ratio?.

2 Which has a bigger SA:V ratio, a small organism or a large organism?

3 Why have large mammals developed complex blood systems and lungs?

4 What type of cells are the alveoli walls made of?

5 Does the volume of the thorax increase or decrease when you breathe out?

6 Which two sets of muscles contract when we breathe in?

7 Write a list of the organs in the Digestive system and state their function in digesting food.

Circulatory System Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. Describe the function of the circulatory system? (2)			
2. State the 4 chambers of the heart (4)			
3. Name the vessel carrying oxygenated blood to the heart (1)			
4. Name the vessel carrying deoxygenated blood away from the heart (1)			
5. Name the vessel carrying oxygenated blood away from the heart (1)			
6. Name the vessel carrying deoxygenated blood to the heart (1)			
7. Describe 2 differences in structure between arteries and veins (2)			
8. What is the name given to the structures that separate the top chambers from the bottom chambers (1)			

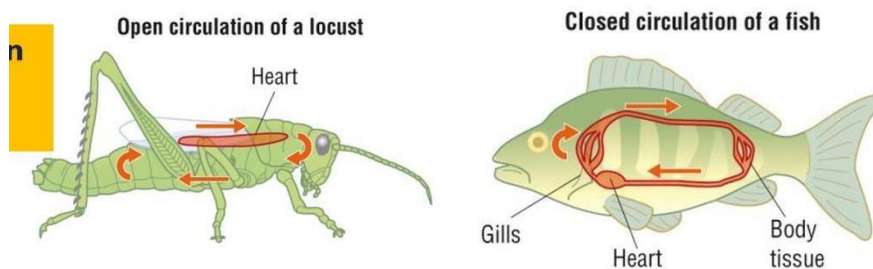
9. Name the order of chambers the blood flows through the heart (4)			
10. Name the order of vessels the blood flows through the heart (4)			
11. What is the difference between oxygenated and deoxygenated blood (1)			
12. What is the pigment inside red blood cells that carries oxygen? (1)			
TOTAL / 23			

Circulatory System Building Knowledge

The circulatory system and blood vessels

Large multicellular organisms have a small surface area to volume ratio and have evolved a complex circulatory system to transport chemicals around the body, this is called the **CIRCULATORY SYSTEM**.

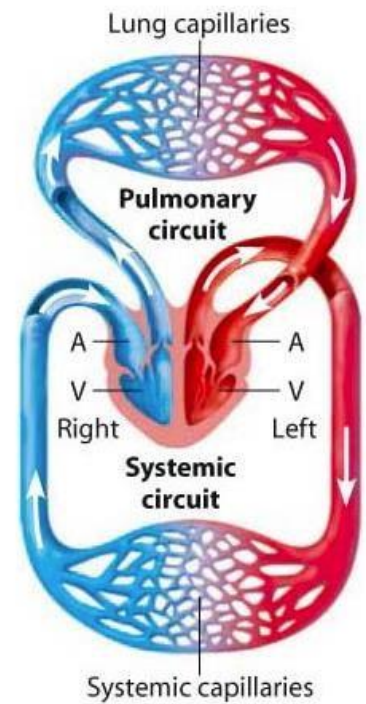
Some organisms such as flat worms can diffuse oxygen and glucose across their surface. Less active organisms such as **insects** may have a much more simplified circulatory system.



Fish have a more complex system where the blood enters the heart once before being transported to the **systemic system** this is called a single circulatory system.

Mammals have evolved a **double circulatory system** with a **pulmonary** and a **systemic** circuit.

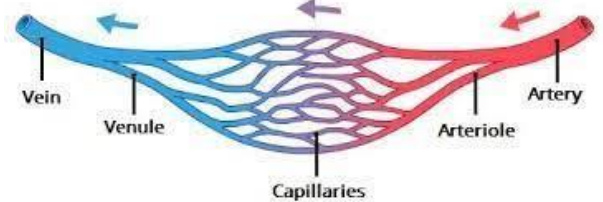
The **heart** pumps the **deoxygenated** blood to the lungs (pulmonary system) to pick up oxygen and removes carbon dioxide. The **oxygenated** blood is then returned to the heart to be pumped out to the organs (systemic system).



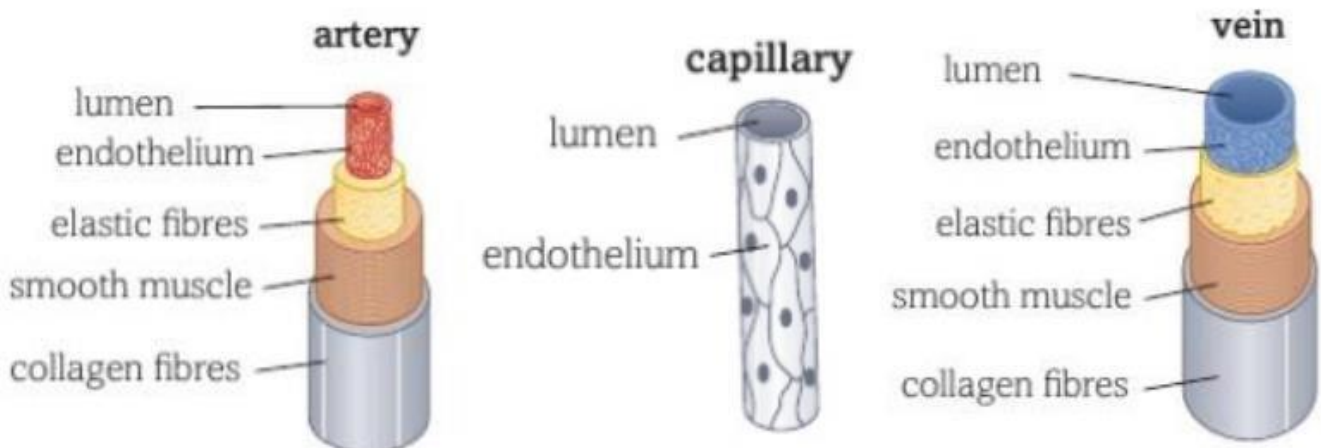
The blood travels through 3 main types of blood vessels:

1) **The Arteries;** carry blood away from the heart. They have a thick layer of elastic tissue and smooth muscle. The elastic walls stretch when the heart contracts and the elastic tissue recoils to maintain the pressure.

2) **Capillaries;** These consist of a single layer of endothelial cells. The arteries subdivide into arterioles which further divide into thousands of capillaries. The capillaries come into close contact with body cells providing a huge surface area to volume ratio and a short diffusion distance for the exchange of oxygen, glucose, carbon dioxide, urea and other substances.



3) **Veins;** The capillaries start to come back together forming venules and then veins. Veins carry blood back towards the heart. Blood is at a lower pressure and therefore do not need such a thick layer of elastic tissue or smooth muscle. The veins contain valves to prevent the blood flowing backwards.



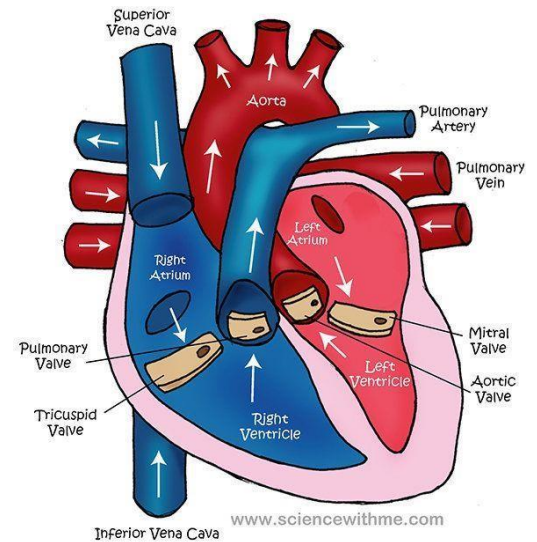
The heart

The heart has two separate pumps. The right side of the heart pumps blood to the lungs and the left side pumps blood to the body.

Blood flows from a region of **higher pressure** to a region of **lower pressure**.

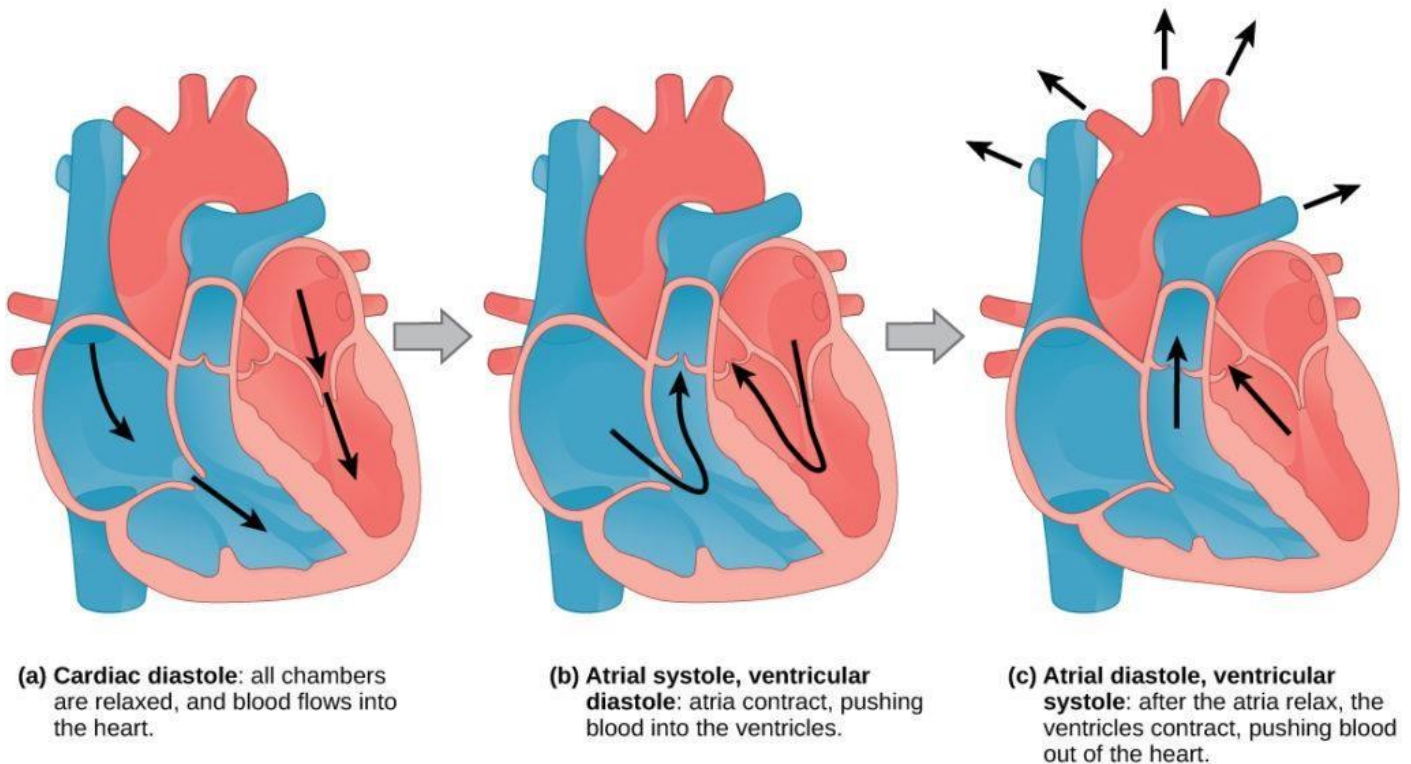
Valves within the heart keep the blood flowing in the correct direction by preventing backflow. Valves open and close in response to the changes of pressure inside the chambers and do not require energy.

The heart is made up of 4 chambers; the **right atria**, the **right ventricle**, the **left atria** and the **left ventricle**. The left side of the heart has a thicker muscular wall to create enough pressure to force the blood around the whole body. The heart's contractions are initiated by a cluster of specialised cells called the **SINO-ATRIAL NODE** or the **PACEMAKER**. These cells send out electrical impulses at regular intervals. The coronary arteries are very thin and supply the muscle in the heart with blood.



The cardiac cycle

This is the sequence of events that occur in a single heartbeat.



Questions:

1 Name the four chambers around the heart.

2 Name the three main types of blood vessels.

3 In which type of blood vessel are substances exchanged between the blood and the cells?

4 Where does the right-hand side of the lungs pump blood to?

5 What is the function of the valves in the heart?

6 Where does the blood go after leaving the atria?

7 What is the function of the sino-atrial node?

8 Why does the heart muscle require a blood supply?

9 Name the blood vessels that supply blood to the heart muscles.

10 Describe the stages of the cardiac cycle.

Neurones and The Nervous System Prior knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. Name the main body of the neurone (1)			
2. Name the different parts of the central nervous system (3)			
3. What do neurones do? (1)			
4. How can neurone carry out its function fast? (1)			
5. What is a relay in the nervous system? (2)			
6. Do neurones touch? (1)			
7. What is the last part of a neurone cell called? (1)			
8. What is its job? (see last question) (2)			
9. What is an Action potential? (3)			
10. What is the role of Neurotransmitters? (2)			
TOTAL		/ 17	

GENETICS GCSE PRIOR KNOWLEDGE

4) Genetics

- a) Genetics and Cell Division Key Definitions
- b) Homeostasis

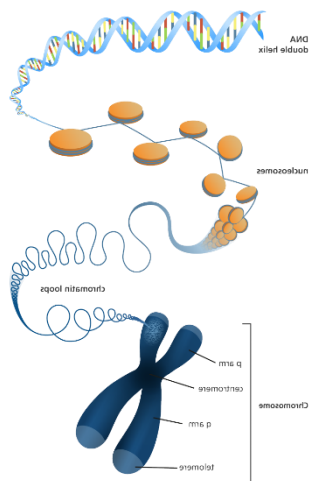
Genetics Key Definitions and Cell Division Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. Define Mutation (1)			
2. Define Allele (1)			
3. Define Chromosome (1)			
4. Define Gene (1)			
5. Define Mitosis (1)			
6. Define Meiosis (1)			
7. Define Biodiversity (1)			
8. Define Adaptations (1)			
9. Define Interdependence (1)			
10. Define Genotype (1)			

11. Define Phenotype (1)			
12. Define Species (1)			
TOTAL / 12			

Genetics Key Definitions and Cell Division Building Knowledge

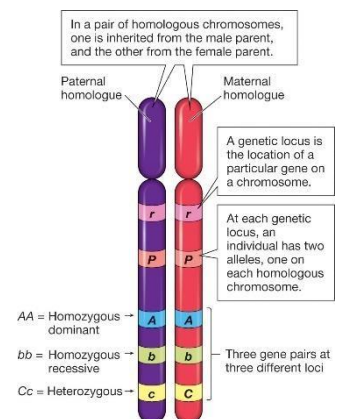
Genetics and cell division



The **DNA** molecule contains thousands of **genes** along its length. The DNA molecule is wound up into a **chromosome**. Each body cell in a human contains 23 pairs of chromosomes (**diploid** number), one from the mother and one from the father. These pair up to form a **homologous pair**, both the same size and containing the same **genes** (these genes can be different **alleles**).

A chromosome is often seen as an X shaped molecule. The X shape is just one chromosome attached to an exact copy of itself (2

CHROMATIDS). They are joined together by an attachment called a **centromere**. In preparation for cell division the chromosome will make a copy of itself. All damaged tissue and cells are replaced by a process of cell division called **MITOSIS**. Mitosis is also seen in **asexual reproduction**; the offspring are genetically identical to the parent.



Mitosis cell division;

Interphase; DNA molecules are indistinct in the nucleus. They replicate their DNA, attaching at the centromeres.

Prophase; The DNA becomes **supercoiled** and **compact** and can now be seen under a light microscope. It has the X shape.

Metaphase; the nuclear membrane breaks down, the chromosomes line up along the **equator** of the cell and **spindle fibres**, produced by the **centrioles**, attach to the chromosomes.

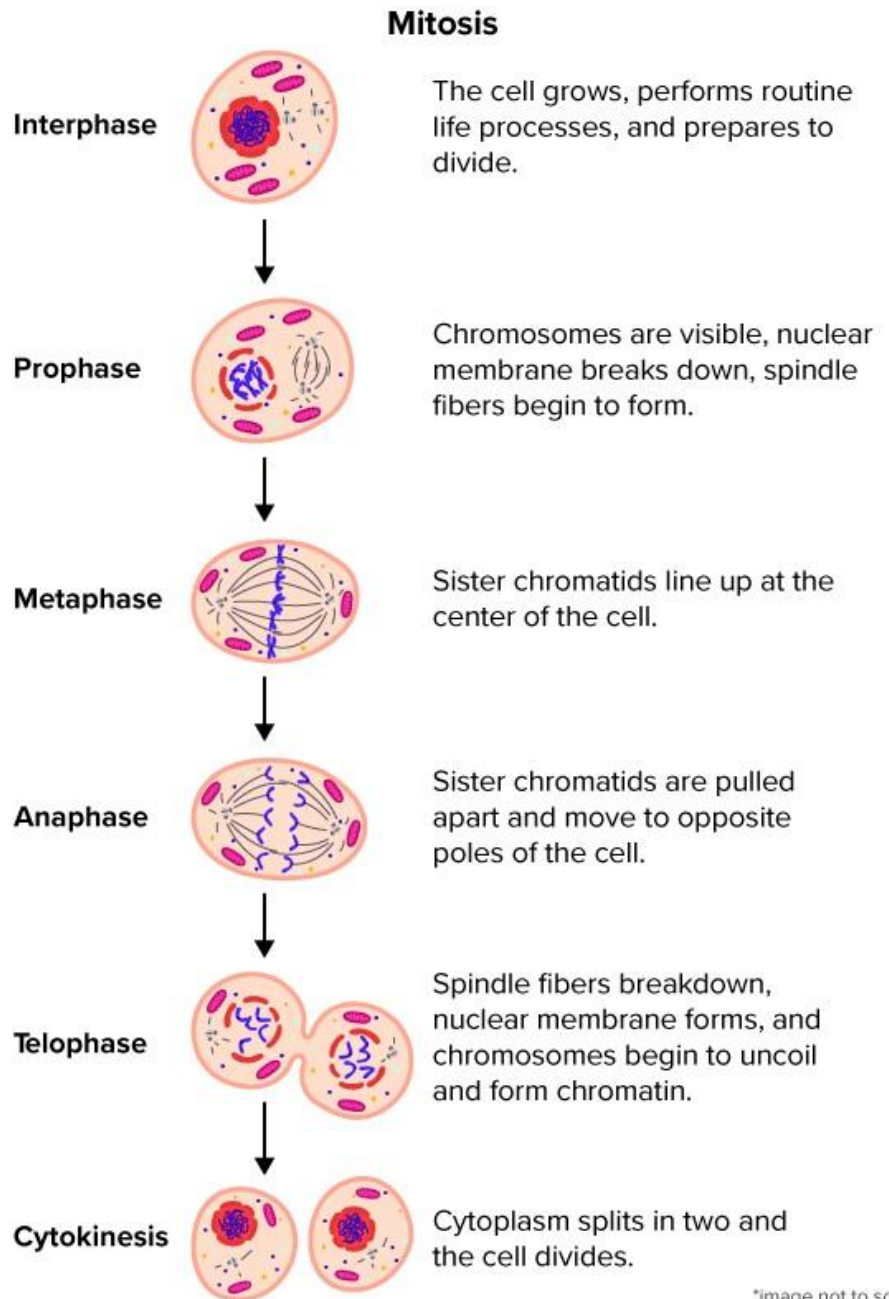
Anaphase; The **spindle fibres** pull the **centromere** apart and the **chromatids** separate and are dragged to the poles of the cell.

Telophase; A **nuclear envelope** forms around each set of **chromatids** and the **cytoplasm divides** forming 2 genetically identical cells.

Meiosis;

This cell division is responsible for the production of sex cells and introduces genetic variation.

It results in the formation of gametes containing half the original genetic information (**haploid** number). This ensures, that during fertilisation, the embryo obtains two complete sets of genetic information.



In meiosis the cell undergoes 2 cellular divisions.

1) **Prophase I**

The chromosomes condense and the nuclear envelope breaks down. Homologous chromosomes pair up and can cross over DNA (Recombination).

2) **Metaphase I**

The homologous pairs arrange themselves randomly along the equator.

3) **Anaphase I**

Spindle fibres attach to the centromere and pull the chromosomes to opposite poles.

4) **Telophase I** Two nuclear envelopes surround the divided genetic information. Each contains half the number of chromosomes.

5) **Prophase 2**

New nucleus breaks down and chromosomes coil and condense.

6) **Metaphase 2**

Spindle fibres attach to the centromeres.

7) **Anaphase 2**

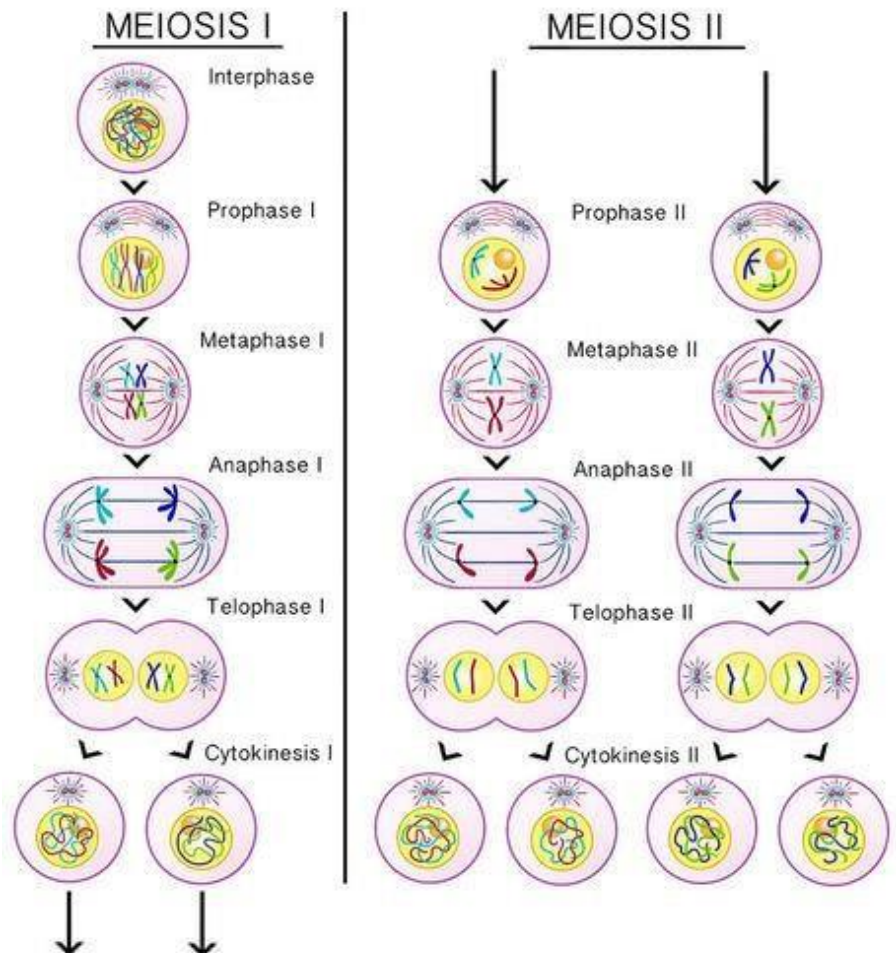
The spindle fibres start to drag the chromatids to opposite sides of the cell.

8) **Telophase 2**

The nuclei's start to reform and the cytoplasm splits to form 4 haploid cells that are genetically different to the parent cells.

Questions:

1 Which cell division forms haploid cells?



2 What happens during prophase?

3 What do centrioles do?

4 Which organs produce haploid cells?

5 What happens in telophase?

Homeostasis Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. What is Homeostasis? (1)			
2. How does the body control levels of glucose? (2)			
3. How does the body control temperature levels? (2)			
4. How does the body control water levels? (2)			
5. What do glands do in the body? (2)			
6. Which gland is responsible for growth? (1)			

6. What is sodium used for in the body? (2)			
TOTAL / 12			

Homeostasis Building Knowledge

Homeostasis maintains optimal conditions for *enzyme* action throughout the body, as well as all cell functions. It is the maintenance of a constant internal environment despite changes in internal and external conditions.

In the human body, these include the control of:

- blood *glucose* concentration
- body temperature
- water levels

The importance of homeostasis

Enzymes are proteins that catalyse (speed up) vital chemical reactions inside the body. Enzymes will only function properly under a small range of certain conditions, such as preferred pH and temperature. If any conditions are outside their specific range then the enzymes cannot function. This could cause the organism to die. Homeostasis relies on automatic control systems that include nervous responses (*nervous system*) or chemical responses (endocrine system). *Receptors* and *effectors* are also needed.

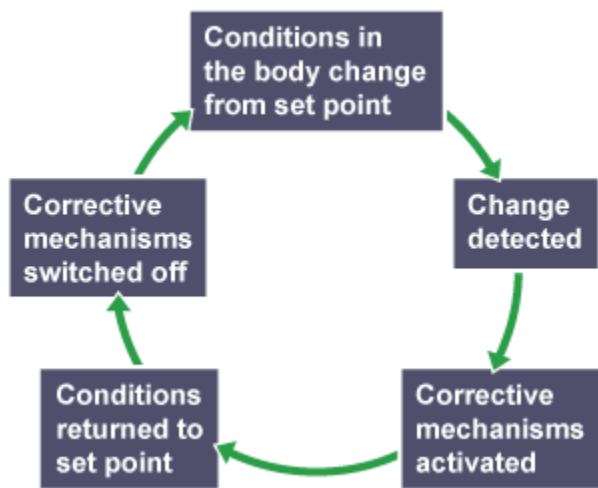
Negative feedback systems

A negative *feedback mechanism* is an important type of control that is found in homeostasis. It responds when conditions change from the ideal or set point and returns conditions to this set point. There is a continuous cycle of events in negative feedback.

General stages in negative feedback

In general this works in the following way:

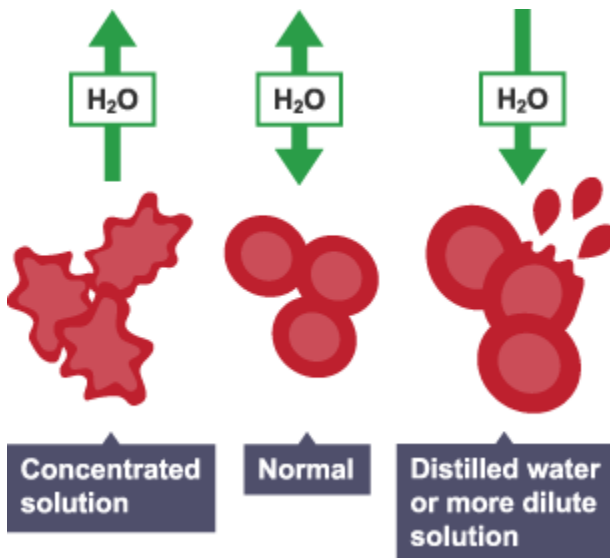
- if the level of something rises, control systems reduce it again
- if the level of something falls, control systems raise it again



Negative feedback - example

Body temperature is controlled by the hypothalamus in the brain. If the hypothalamus detects that the body is too hot, the response is that the body begins to sweat to try and reduce the temperature back to the correct level. Once the body temperature is back to the correct level, sweating will stop. In the opposite way, if the hypothalamus detects that the body is too cold then the response is that the body begins to shiver to try and raise the temperature back to the correct level. Once the body temperature is

back to the correct level the shivering will stop.



Water content in the blood

Osmoregulation is the control of water levels and mineral salts in the blood.

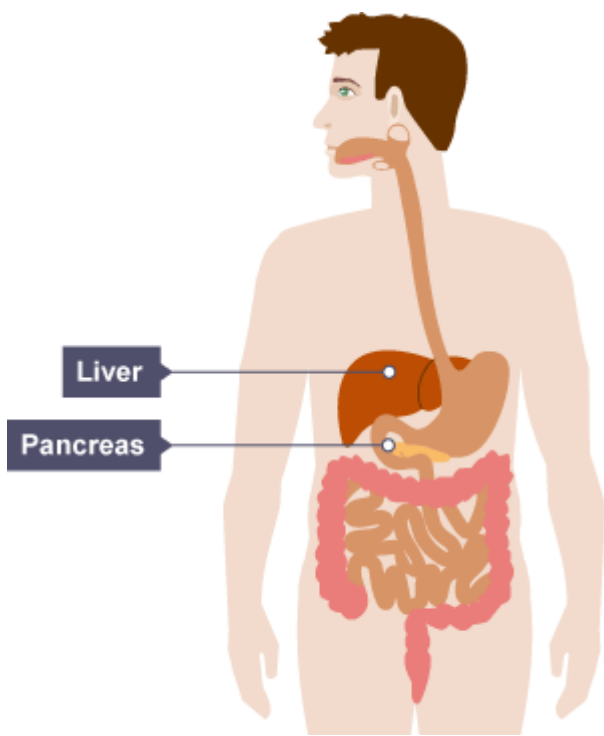
Water levels and mineral salts in the blood are controlled to protect animal cells by stopping too much water from entering or leaving them. The concentration of water and salts is the same inside and outside of the cells. If body cells lose or gain too much water by osmosis, they do not function efficiently.

Human excretory organs

The organs of excretion in humans include the skin, lungs and kidneys.

Water is lost from the body as:

- urine from the kidneys
- sweat from the skin
- water vapour, from the lungs when we exhale



Blood glucose regulation

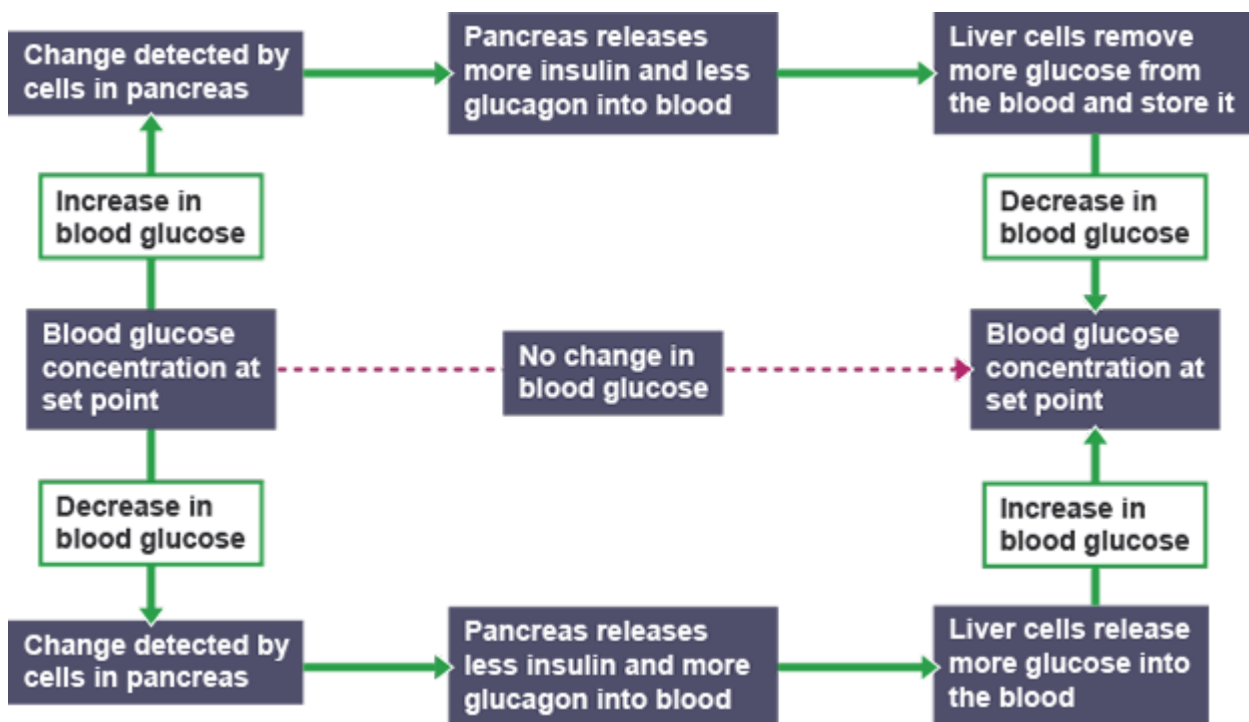
The concentration of glucose in the blood must be kept at a set point. The concentration of glucose in a person's blood can increase after they have eaten a meal containing lots of carbohydrates. The concentration of glucose in a person's blood can decrease after a period of exercise or if they have not eaten for a long while. Glucose diffuses out of the blood into muscle cells and is broken down to release energy for muscle contractions. If the blood glucose concentration rises too high then cells can lose water. This may interfere with cell activities.

If the blood glucose concentration falls too much then body cells will not receive as much glucose and so will not be able to release so much energy

in respiration.

The concentration of glucose in the blood is regulated by the action of the hormones *insulin* and *glucagon*. These hormones are made in the *pancreas* and act on cells in the liver.

The liver acts as the body's glucose 'reservoir'. When the blood glucose concentration gets too high liver cells can take in glucose and store it. When the blood glucose concentration gets too low liver cells can release glucose into the blood



Homeostasis and temperature regulation

The conditions inside our body must be carefully controlled if it is to function effectively. *Homeostasis* is the maintenance of a **constant internal environment in the body**.

The *nervous system* and the *endocrine system* - which produces *hormones* - are involved in homeostasis.

The body control systems have three basic parts:

- *Receptors* detect a stimulus, which is a change in the environment, such as temperature change.
- **Coordination centres** in the brain, spinal cord or a gland (eg the pancreas). These receive information from the receptors, process the information and initiate a response.
- *Effectors*, such as muscles or glands produce the response. Muscles would *contract* while glands would release a hormone, which would restore the optimum condition again.

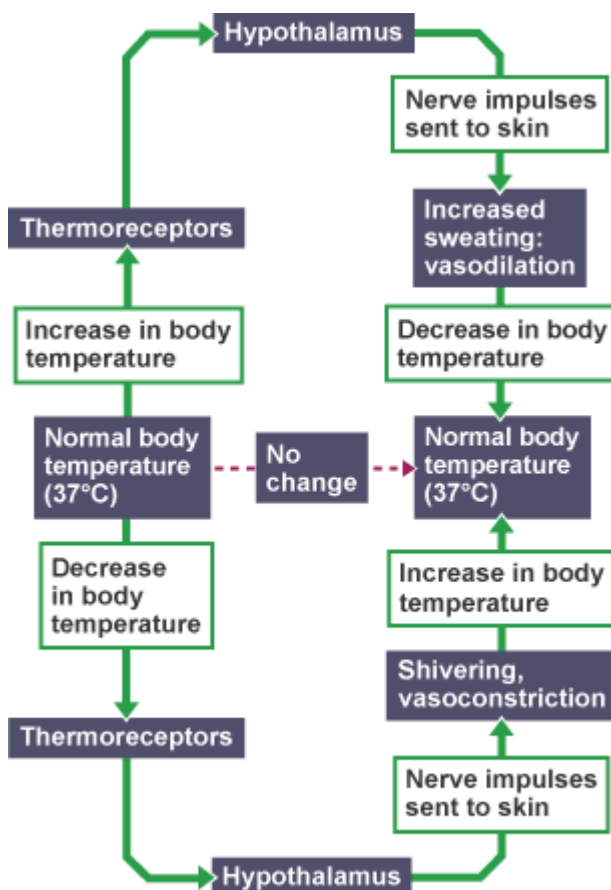
Body temperature

Body temperature is one of the factors that is controlled during homeostasis. The human body maintains the temperature at which *enzymes* work best, which is around 37°C. This process is controlled by the thermoregulatory centre, which is contained in the *hypothalamus* in the brain, and it contains receptors sensitive to the temperature of the blood. The skin also has temperature receptors and sends nervous impulses back to the thermoregulatory centre.

Too cold

When we get too cold:

- Skeletal muscles contract rapidly and we **shiver**. These contractions need energy from *respiration*, and some of this is released as heat.
- **Blood vessels**, which lead to the skin capillaries, become narrower - they constrict - which allows less blood to **flow** through the skin and conserve the core body temperature. This is called *vasoconstriction*.



Too hot

When we get too hot:

- **Sweat glands** in the skin release more sweat. The sweat evaporates, transferring heat energy from the skin to the environment.
- Blood vessels leading to the skin capillaries become wider - they **dilate** - allowing more blood to flow through the skin, and more heat to be lost to the environment. This is called *vasodilation*.

The hairs on the skin also help to control body temperature. The hairs lie flat when we are warm, and rise when we are cold.

If we are too cold, nerve impulses are sent to the hair erector muscles which contract. This raises the skin hairs and traps a layer of insulating air next to the skin.

The control of body temperature is an example of a **negative feedback mechanism**. It regulates the amount of:

- shivering (rapid muscle contractions release heat)
- sweating (evaporation of water in sweat causes cooling)

- blood flowing in the skin capillaries

Questions:

1 Explain how the body keeps cool?

2 Explain how the body gets rid of excess water?

3 How can too much water in the body affect the brain?

4 Explain how the pancreas acts when someone has Diabetes?

MATH SKILLS GCSE PRIOR KNOWLEDGE

5) Maths Skills

Averages, Modes and Range Prior Knowledge

QUESTION	ANSWER	MARK (✓ OR X)	CORRECTION (IF NEEDED)
1. What is the mean of these numbers: 3, 5, 7, 9? (1)			
2. Here's a list of pocket money that a class of children get. What's the mean? £3.50, £2.40}, £1.50, £2, £3.30, £2.80, £5, £6, £2.50 (1)			
3. The mean height of 5 children is 1.63m. What's the mean if they're joined by another child who's 1.75m tall? (1)			
4. Here's the number of goals scored in Premier League fixtures one Saturday: 1, 5, 3, 5, 1, 3, 4, 1, 2. What's the median? (1)			
5. Here's the number of goals scored in Premier League fixtures one Saturday: 1, 5, 3,			
5, 1, 3, 4, 1, 2. What's the mode? (1)			
6. Here's a set of marks for a maths class: 12, 45, 78, 66, 39, 98, 25, 48, 66, 41. What's the range? (1)			
7. Here are the results Owen got by throwing a dice a number of times: 1, 5, 3, 4, 2, 5, 5, 3, 6, 2, 1, 3, 2, 5, 4, 3, 3, 5. What's the mode? (1)			
8. Calculate 1% of 8.3 (1)			
9. Calculate 22.5% of 162.4 (1)			
TOTAL			/9

CPAC 2C Identifying and controlling variables task:

Variables

For each of the following case studies name the:-

(A) Independent variable (B) Dependant variable (C) Control variable

Case study 1 – Measuring gravity

The aim of this experiment is to find out how fast objects of different masses take to fall from height. To conduct this experiment we used a number of different sized steel ball-bearings, which had different masses. Each ball-baring was weighed on scales, before being dropped from a marker exactly 2 m from the floor. The time the ball bearing took to drop was timed on a stopwatch, and repeated 3 times for each ball-bearing to gain an average time.

Case study 2 – The colour of summer

The aim of this experiment is to find out if the colour of water a flower is grown in affects the colour of the flower. Five white roses of a similar size and shape were selected and placed into 5 separate beakers each containing 250 ml of water. Each of the 5 beakers had a few drops of one of five different colours of food dye added to it (red, green, blue, yellow and brown). The beakers were then placed on a windowsill and the colour of the flowers monitored twice a day for two weeks.

Case study 3 – how far does the spring stretch?

The aim of this experiment is to find out how far different masses stretch a spring. A spring was hung from a clamp stand, and its length end to end measured. A 10g mass was then added and the length of the spring measured and recorded. This was repeated adding 10g between 0g and 100g.

Variables – answer sheet:

Case study 1 – Measuring gravity:

(A) Independent variable:

(B) Dependant variable:

(C) Control variables + how/why:

Case study 2 – The colour of summer:

(A) Independent variable:

(B) Dependant variable:

(C) Control variables + how/why:

Case study 3 – How far does the spring stretch?

(A) Independent variable:

(B) Dependant variable:

(C) Control variables + how/why:

Challenge for Top Students

You could have a look at some of the following:

Virology & Global Health

- Explained: The Next Global Pandemic (20 mins)
<https://www.netflix.com/watch/81062202?trackId=13752289&tctx=0%2C3%2C0d03e68c-6321-41f2-9dfa-11f336ddc8ca-52560540%2C%2C>
- FutureLearn course on Coronavirus:
<https://www.futurelearn.com/courses/covid19-novel-coronavirus> •
- The Life Scientific - viruses:
<https://www.bbc.co.uk/programmes/m0009b2t>

Genetic Modification

- Can Science Make Me Perfect? <https://www.bbc.co.uk/iplayer/episode/b0b6q3qy/can-science-make-me-perfect-with-alice-roberts>
- Explained: Designer DNA (20 mins)
<https://www.netflix.com/search?q=science&jbv=80216752&jbp=2&jbr=1>
- In Our Time: Neanderthals <https://www.bbc.co.uk/programmes/b00sq1nv>
- The Life Scientific: evolution of cancer <https://www.bbc.co.uk/programmes/m0003ks6>

Homeostasis & Hormones

- Interviews with researchers working on hormones:
<https://endocrinepod.com/episodes/> •
- Open University course on diabetes:
<https://www.open.edu/openlearn/science-maths-technology/biology/livingdiabetes/content-section-3.1>