KS4 Combined Science

Organisation Higher Home Learning Booklet

Rastrick
High School & Sixth Form

Name: _____

Class: _____

Teacher: _____

4.2 Organisation

In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.

Lesson 1 – Tissues, organs, organ systems
Lesson 2 – The digestive system (a recap)
Lesson 3 – The role of proteins
Lesson 4 + 5 – Required Practical
Lesson 6 – Circulatory System
Lesson 7 – Respiratory System
Lesson 8 – Blood
Lesson 9 – CHD
Lesson 10 – Lifestyle
Lesson 11 – Cancer
Lesson 12 – Plant Organs
Lesson 13 – Plant Transport Systems
Lesson 14 – Active Transport
Lesson 15 – Revision

Key stage 4 organisation- National Oak Academy Links to lessons

Lesson 2 – The digestive system (a recap)

https://classroom.thenational.academy/lessons/digestion-cnk66c

Lesson 3 – The role of proteins

https://classroom.thenational.academy/lessons/investigating-enzymes-60w64t

Lesson 4 + 5 – Required Practical

https://classroom.thenational.academy/lessons/ph-and-enzymes-part-1-cru3jt

https://classroom.thenational.academy/lessons/ph-and-enzymes-part-2-75h3gr

Lesson 6 – Circulatory System

https://classroom.thenational.academy/lessons/the-heart-6ct3jd

https://classroom.thenational.academy/lessons/heart-rate-6cr32r

Lesson 7 – Respiratory System

https://classroom.thenational.academy/lessons/the-lungs-ccu3ge

Lesson 8 – Blood

https://classroom.thenational.academy/lessons/blood-and-blood-vessels-c8t62c

Lesson 9 – CHD

https://classroom.thenational.academy/lessons/heart-disease-61k68d

Lesson 10 – Lifestyle

https://classroom.thenational.academy/lessons/non-communicable-disease-75jk6r

Lesson 11 – Cancer

https://classroom.thenational.academy/lessons/cancer-c8rp8d

Lesson 12 – Plant Organs

https://classroom.thenational.academy/lessons/plant-tissue-cnh32t

https://classroom.thenational.academy/lessons/plant-roots-61k3jr

Lesson 13 – Plant Transport Systems

https://classroom.thenational.academy/lessons/transport-in-plants-6rr38c

Lesson 1 - Tissues, organs, organ systems

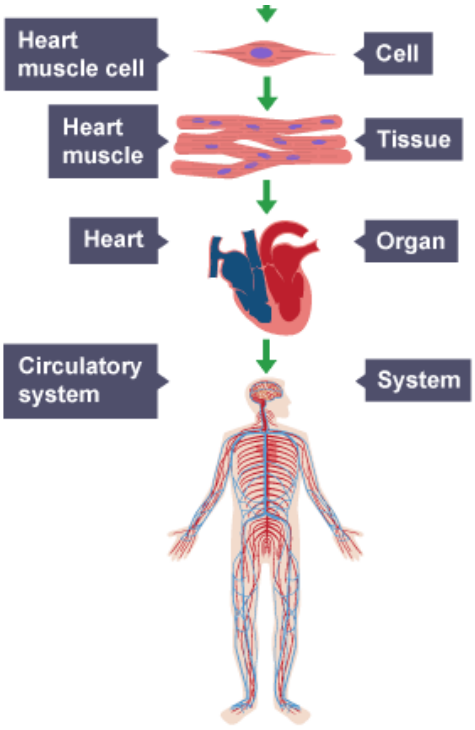
4.2.1 Principles of organisation

Content	Key opportunities for skills development
Cells are the basic building blocks of all living organisms. A tissue is a group of cells with a similar structure and function. Organs are aggregations of tissues performing specific functions. Organs are organised into organ systems, which work together to form organisms.	MS 1c Students should be able to develop an understanding of size and scale in relation to cells, tissues, organs and systems.

Levels of organisation

In order of increasing complexity, multicellular organisms are made of:
cells → tissues → organs → organ systems

Structure	Description
Organelle	A specialised unit within a cell which performs a specific function
Cell	The basic building block of all living organisms
Tissue	A group of cells working together to perform a shared function, and often with similar structure
Organ	A structure made up of groups of different tissues, working together to perform specific functions
Organ system	A group of organs with related functions, working together to perform certain functions within the body



An example of the levels of organisation using the circulatory system.

https://www.youtube.com/watch?v=hqlu2QJPfnc

Task 1 – Complete the table, using the words below.

Stomach lining Human Stomach Digestive system

Photosynthetic system Leaves Leaf epithelium Glandular cells

Palisade cell Daffodil

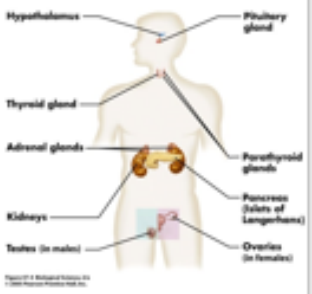
Level of Organisation	Definition	Example in plants	Example in animals
Cells			
Tissues			
Organs			
Organ system			
Organism			

Many cells are **specialised**. They have structures that are adapted for their function.

Muscular tissue

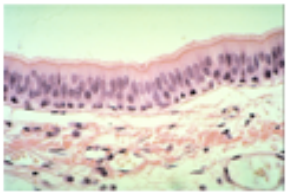
Muscle is a very specialised tissue that has both the ability to contract and the ability to conduct electrical impulses. Muscles are classified functionally as either voluntary or involuntary.

Glandular tissue



Glandular tissue is involved with delivering hormones in the body. This tissue is rich in capillaries. Each cell must contact a capillary directly in order to deliver its hormone to the rest of the body.

Epithelial Tissue



Epithelial tissue covers the whole surface of the body. It is made up of cells closely packed in one or more layers. This tissue is specialised to form the covering or lining of internal and external body surfaces. Epithelial tissue that occurs on surfaces on the interior of the body is known as endothelium.

1. What does specialised mean?

2. What are the two things that muscle tissue can do?

3. Give an example of a muscle with contracts voluntarily and one that contracts involuntarily.

4. Give one example of where glandular tissue is found in the body.

5. Why must the glandular tissue be close to capillaries.

6. Why would the human digestive system need glandular tissue.

7. How are epithelial tissues specialised?

8. Where in the body would you find epithelial tissue?

Lesson 1 – Exam Questions

In a living organism, the cells are organised into organs, systems and tissues.

(a) Use words from the box to complete the list of these structures in order of size.

organs	systems	tissues

The smallest structure is at the top of the list and the largest is at the bottom.

1 **cells**

(smallest

2 _____

3 _____

4 _____

(largest)

5 **organism**

(b) **List A** gives three tissues found in the human body.
List B gives four functions of tissues.

Draw a straight line from each tissue in **List A** to its correct function in **List B**.

List A – Tissue	**List B – Function**
	Covers many parts of the body
Muscular tissue	
	Contracts to cause movement
Glandular tissue	
	Divides by meiosis
Epithelial tissue	
	Releases hormones or enzymes

Draw **one** line from each part of the human body to its correct scientific name.

Part of human body	Scientific name
Layer of cells lining the stomach	An organ
Stomach	An organism
Mouth, stomach, intestines, liver and pancreas	An organ system
	A tissue

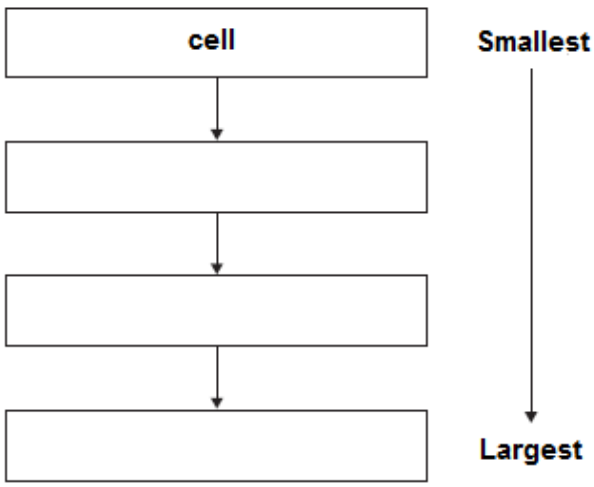
The human body is organised to carry out many different functions.

Use words from the box to complete **Figure 1** by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.

cell	**organ system**	**organ**	**tissue**

Figure 1



Lesson 2 – Digestion

4.2.2.1 The human digestive system

Content	Key opportunities for skills development
This section assumes knowledge of the digestive system studied in Key Stage 3 science.	
The digestive system is an example of an organ system in which several organs work together to digest and absorb food.	
The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used in respiration.	
Bile is made in the liver and stored in the gall bladder. It is alkaline to neutralise hydrochloric acid from the stomach. It also emulsifies fat to form small droplets which increases the surface area. The alkaline conditions and large surface area increase the rate of fat breakdown by lipase.	https://www.youtube.com/watch?v=4ui4oSHHnzA

The human digestive system has two functions:

- breaks down complex food substances
- provides the very large surface area for maximum absorption of food

The digestive system is adapted to the digestion and absorption of food.

Why do we digest food?

We digest our food because nutrients such as proteins, fats and carbohydrates are too large and insoluble so they can't be dissolved into the blood to reach our cells.

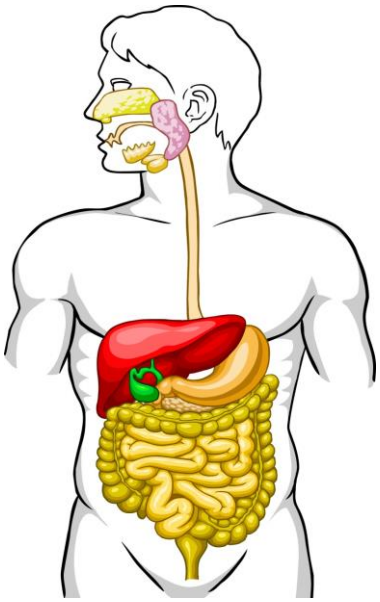
What happens to the digested food?

The products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used in respiration.

Task 1: Label the digestive system:

Words to use:

Small Intestine
Liver
Anus
Large Intestine
Pancreas
Gallbladder
Oesophagus
Mouth
Rectum
Stomach



The digestive system is adapted to the digestion and absorption of food.

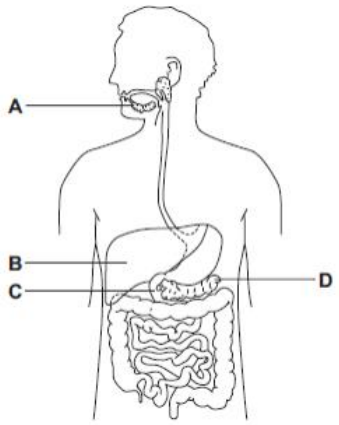
Region	Function
Mouth	Begins the **digestion** of carbohydrates
Stomach	Begins the **digestion** of protein; small molecules such as alcohol absorbed
Small intestine - Duodenum	Continues the **digestion** of carbohydrate and protein; begins the **digestion** of lipids
Small intestine - Ileum	Completes the **digestion** of carbohydrates and proteins into single sugars and amino acids; **absorption** of single sugars, amino acids and fatty acids and glycerol
Large intestine	**Absorption** of water; **egestion** of undigested food

Absorption

The surface of the small intestine wall is folded, and has projections called **villi.**.
The epithelial cells that cover each villus themselves have projections called **microvilli**.
These all increase the surface area over which digested food – now simple molecules – is absorbed.
Most of the digested food passes through the epithelial cells of the gut wall and is carried by blood to the liver. Digested lipids pass through the gut wall and enter the lacteals.

Lesson 2 – Exam Questions

1 The diagram shows part of the human digestive system.



(a) Name the parts of the digestive system labelled **A**, **B**, **C** and **D**.

A _____

B _____

C _____

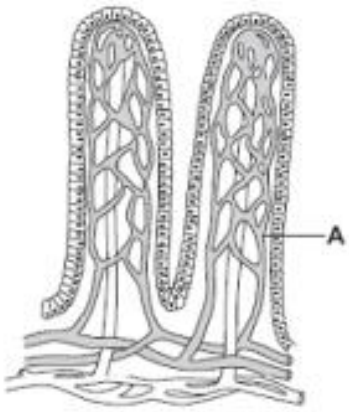
D _____

(4)

1 Villi are found in some parts of the digestive system.

Diagram 1 shows two villi.

Diagram 1



(a) Draw a ring around the correct answer to complete each sentence.

(i) Structure **A** is a

muscle.
nerve.
capillary.

(1)

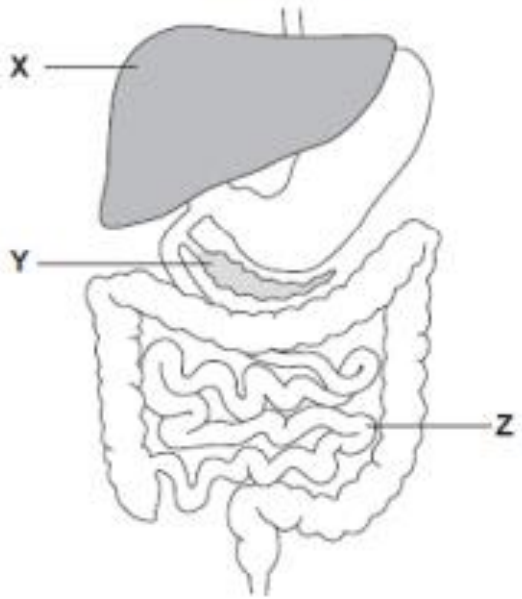
(ii) The villi absorb the products of digestion by

dialysis.
diffusion.
osmosis.

(1)

(b) **Diagram 2** shows the digestive system.

Diagram 2



(i) In which part of the digestive system, **X**, **Y** or **Z**, are most villi found?

(1)

(ii) There are about 2000 villi in each cm^2 of this part of the digestive system.

Why is it helpful to have lots of villi?

_____

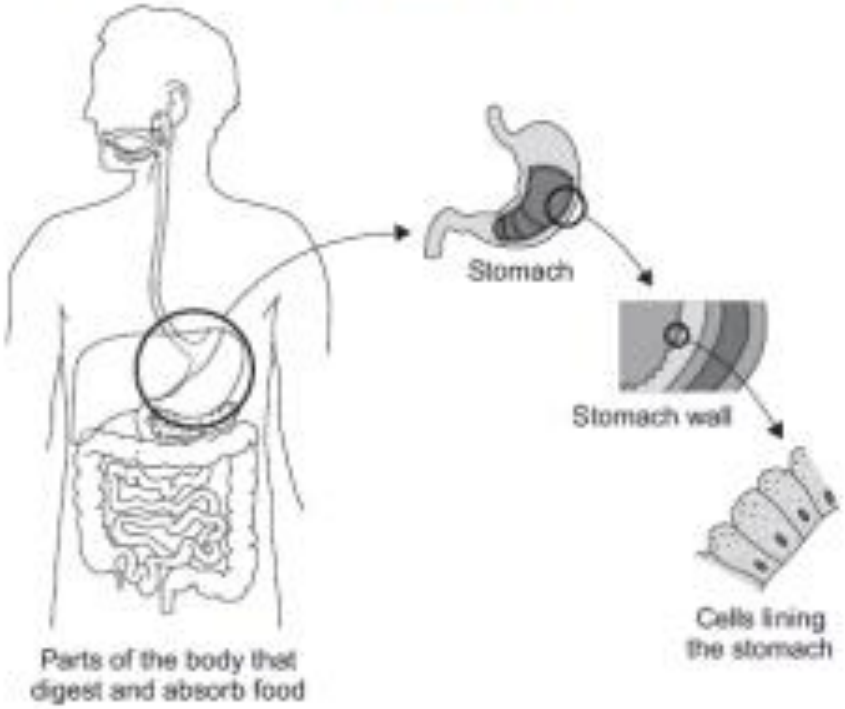
_____

(1)

(Total 4 marks)

2 The diagram below shows the parts of the body that digest and absorb food.

It also shows some details about the structure of the stomach.



(a) Complete the table to show whether each structure is an organ, an organ system or a tissue.

For each structure, tick (✓) **one** box.

Structure	Organ	Organ system	Tissue
Stomach			
Cells lining the stomach			
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine			

(2)

(b) (i) The blood going to the stomach has a high concentration of oxygen.
The cells lining the stomach have a low concentration of oxygen.

Complete the following sentence.

Oxygen moves from the blood to the cells lining the stomach by

the process of _____ .

(1)

(ii) What other substance must move from the blood to the cells lining the stomach so that respiration can take place?

Draw a ring around the correct answer.

glucose **protein** **starch**

(1)

(iii) In which part of a cell does aerobic respiration take place?

Draw a ring around the correct answer.

cell membrane **mitochondria** **nucleus**

(1)

(Total 5 marks)

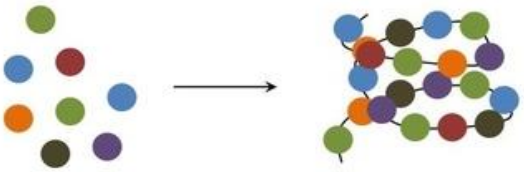
Additional Notes:

Lesson 3 – The role of proteins

	development
Students should be able to use the 'lock and key theory' as a simplified model to explain enzyme action. Students should be able to recall the sites of production and the action of amylase, proteases and lipases. Students should be able to understand simple word equations but no chemical symbol equations are required. Digestive enzymes convert food into small soluble molecules that can be absorbed into the bloodstream. Carbohydrases break down carbohydrates to simple sugars. Amylase is a carbohydrase which breaks down starch. Proteases break down proteins to amino acids. Lipases break down lipids (fats) to glycerol and fatty acids. Students should be able to relate knowledge of enzymes to Metabolism. Enzymes catalyse specific reactions in living organisms due to the shape of their active site.	WS 1.2 Students should be able to use other models to explain enzyme action.

What are Proteins?

Large molecules composed of one or more long chains of **amino acids** and are an essential part of all living organisms.

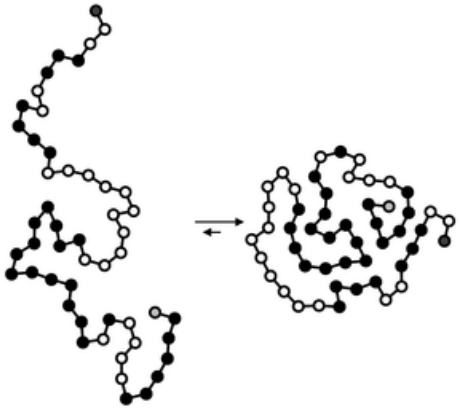


amino acids protein

We get proteins from the food we eat. We digest the proteins in our food so they are broken down into smaller amino acids. Our body uses these small amino acids to make proteins that we need. Proteins play many key roles in our body.

Structure of Proteins:

Long chains of amino acids make proteins. The **amino acids** are also known as **monomers**. The long **protein** is known as a **polymer**. Long protein chains folds to make a specific 3D shape. The shape of proteins is very important for them to work correctly.

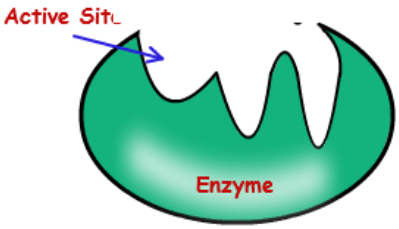


Enzymes:

An example of this is **Enzymes**. Enzymes are proteins that have a very specific shape to help them do their job. Some chemical reactions in our body happen too slowly on their own.

For example when we digest food. Without enzymes to help, this process would take too long and we wouldn't get the nutrients that we need.

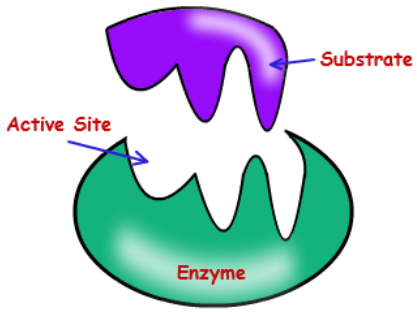
Enzymes speed a chemical reaction up. They are a **biological catalyst.**



Enzymes have a specific shape, with a region known as the active site. The **active site** works in various ways, it's designed to bring two molecules closer together so they react.

But its specific shape means that it will only interact with certain **substrates** that also have the same shape. This is essential to the enzyme being able to work.

The **substrate** is the molecule taking prt in the chemical reaction, and fits into the active site.



One enzyme is therefore specific to one substrate's chemical reaction, or type of chemical reaction. Enzymes have a specific 3D structure.

This theory for the way in which enzymes work is called the **lock and key theory**.

Task 1: Write down if the following statements are **true** or **false**:

1. Enzymes are made up of carbohydrate molecules.
2. Enzymes are biological catalysts.
3. The specially shaped region of an enzyme molecule is called the active mouth.
4. Enzymes are non-specific.
5. Enzymes speed up the reactions.

Task 2: Fill In the gaps:

Enzymes are …… catalysts - catalysts are substances that ……the rate of chemical reaction. Enzymes are …… that are folded into complex 3D shapes. The place where these substrate molecules fit is called the ……. …….

Digestive Enzymes:

Carbohydrases break down carbohydrates in several regions of the digestive system. Most of the carbohydrate we eat is starch, so this will be the main **substrate** in the early part of digestion for enzyme action.

Proteases break down proteins in several regions of the digestive system.

Lipases break down lipids in one region of the digestive system.

Additional Notes:

_____

_____

_____

_____

_____

_____

_____

https://www.youtube.com/watch?v=6jz9WvfKDVc

Enzymes are special p_____ that can break large molecules into small molecules; they act as biological c_____. Different types of enzymes can break down different n_____.

enzyme	reaction catalysed
A_____	starch → sugars
protease	P_____ → amino acids
lipase	lipids → f_____ a_____ + glycerol

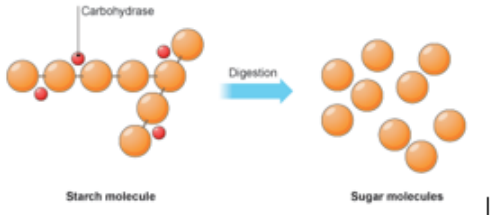
Different parts of the gut produce different enzymes.

enzyme	where produced
amylase	S_____ glands, p_____, small intestine
protease	S_____, pancreas, small i_____
lipase	P_____, small intestine

Carbohydrates

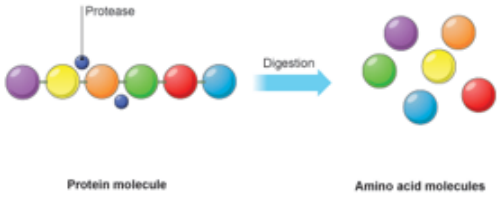
Carbohydrates are digested in the **mouth**, **stomach** and **small intestine**. **C_____** enzymes break down **starch** into **sugars**.

The saliva in your **mouth** contains **a_____**, which is another starch digesting enzyme. If you chew a piece of bread for long enough, the **starch** it contains is digested to **sugar**, and it begins to taste sweet.



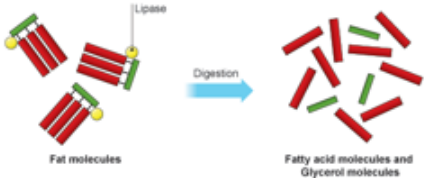
Proteins

Proteins are digested in the **stomach** and **small intestine**. **P_____** enzymes break down **proteins** into **a_____ a_____**. Digestion of proteins in the stomach is helped by **stomach acid**, which is strong hydrochloric acid. This also kills harmful micro-organisms that may be in the food.



Fats

L_____ enzymes break down fat into **fatty acids** and **glycerol**. Digestion of fat in the **small intestine** is helped by **b_____**, made in the liver. Bile breaks the fat into small droplets that are easier for the lipase enzymes to work on.



Lesson 3 – Exam Questions

1 Bread contains starch, protein and fat.

(a) Complete each sentence by choosing the correct words from the box.

amino acids	**protein**
fat	**starch**
fatty acids	**sugar**

Amylase speeds up the digestion of _____ . The product of this digestion is _____ . Protease speeds up the digestion of _____ . The product of this digestion is _____ .

(4)

(b) Why do molecules of starch, protein and fat need to be digested?

_____

_____

(2)

(c) In which part of the digestive system does the digestion of starch begin?
Draw a ring around your answer.

large intestine **mouth** **small intestine** **stomach**

(1)

(d) What do we call substances like amylase and protease which speed up chemical reactions?

_____

(1)

(Total 8 marks)

2 (a) (i) What name is given to an enzyme which catalyses the breakdown of protein?

_____

(1)

(ii) What product is formed when protein is broken down by the enzyme?

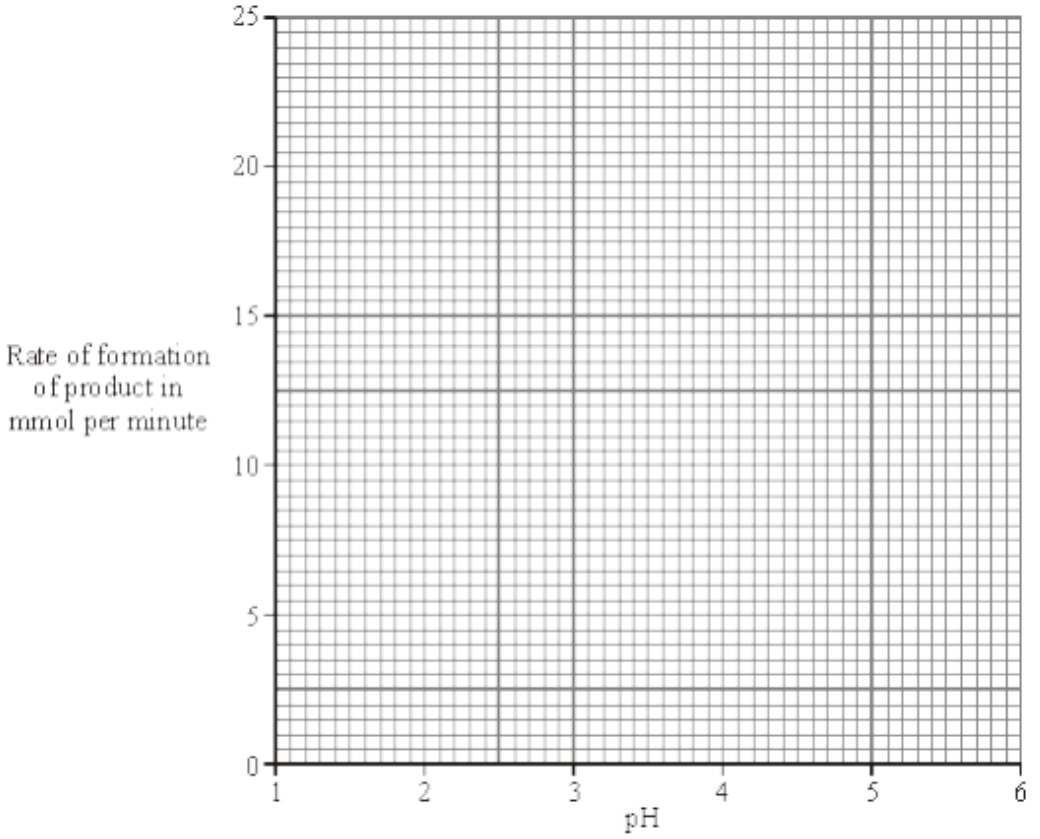
_____

(1)

The table shows the effect of pH on the activity of an enzyme which catalyses the breakdown of protein.

pH	1.0	2.0	3.0	4.0	5.0
Rate of formation of product in mmol per minute	10.5	23.0	10.5	2.5	0.0

(b) Draw a graph of the data in the table.



(c) The enzyme is produced by the human digestive system.

(i) At what pH does this enzyme work best? _____

(1)

(ii) Suggest which part of the digestive system produces this enzyme.

_____

(1)

(d) Why is it necessary to break down proteins in the digestive system?

_____

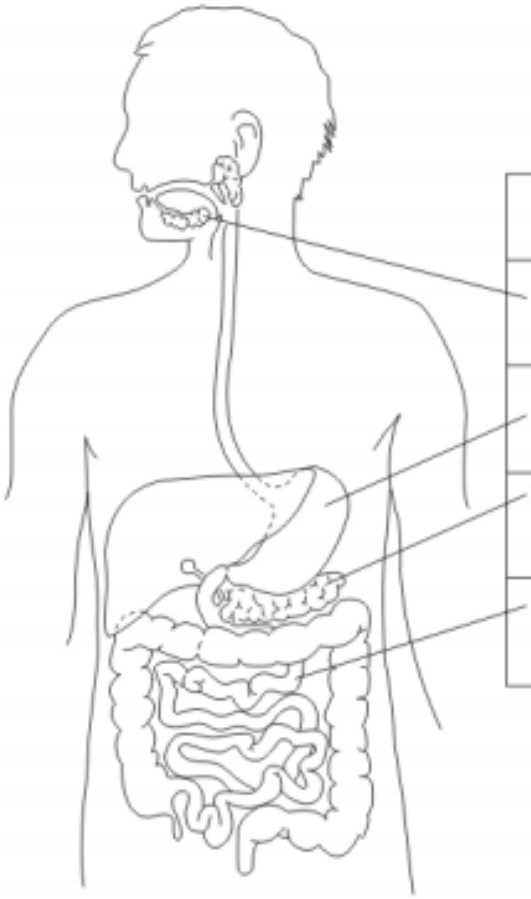
_____

_____

_____

_____

3 The diagram gives information about some parts of the human digestive system.



Organ	pH of digestive juice	Enzymes produced
Salivary gland	7	Amylase
Stomach	2	Protease
Pancreas	8.5	Amylase Lipase Protease
Small intestine	8.5	Amylase Lipase Protease

(a) (i) Name the organ which **makes** bile.

_____

(1)

(ii) Label this organ with the letter **X** on the diagram.

(1)

Information in the table may help you to answer parts (b) and (c).

(b) Name **two** parts of the digestive system where protein is digested.

1. _____

2. _____

(2)

(c) Suggest **two** reasons why starch is not digested in the stomach.

1. _____

_____

2. _____

_____

(2)

(Total 6 marks)

4 There are enzymes in biological washing powders. Biological washing powder has to be used at temperatures below 45 °C.

(a) The enzymes in biological washing powders do **not** work on the stains on clothes at temperatures above 45 °C.

Explain why.

_____

_____

_____

_____

(2)

(b) Some bacteria, called thermophilic bacteria live in hot springs at temperatures of 80 °C.

Scientists have extracted enzymes from these thermophilic bacteria. These enzymes are being trialled in industrial laundries.
The laundries expect to increase the amount of clothes they can clean by using enzymes from thermophilic bacteria instead of using the biological washing powders the laundries use now.

(i) The laundries expect to be able to increase the amount of clothes that they can clean each day.

Suggest why.

_____

_____

_____

_____

_____

Lesson 4 & 5 – Required Practical

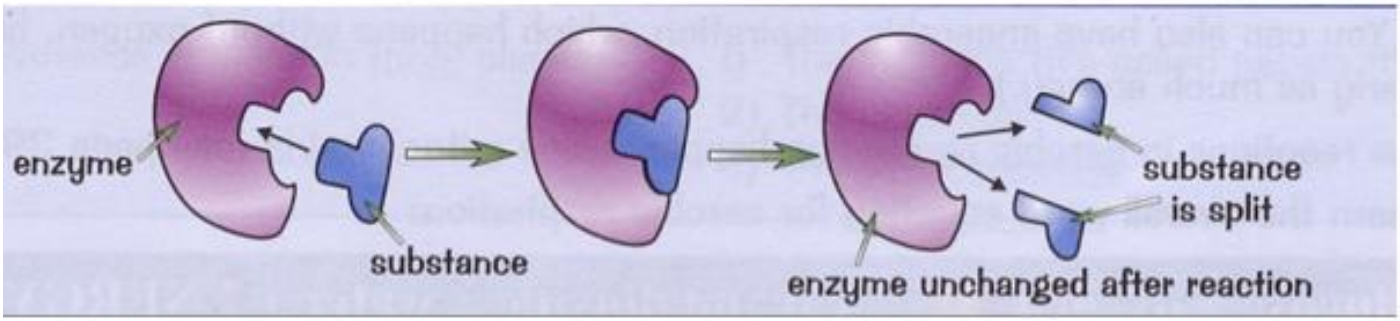
Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme.

Students should use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or electric heater.

DART – Read the following passage and highlight / underline areas that impact the rate of reaction with an enzyme.

For any chemical reaction to occur, it needs some energy to get it going e.g. lighting a Bunsen burner or a piece of wood. This is called the activation energy. Enzymes are proteins found inside our cells which speed up chemical reactions in our body, by lowering this activation energy.

They work because part of the enzyme called the active site has a specific shape into which chemicals, called substrates, can fit. The chemical reaction then occurs and the products of the reaction are released, whilst the enzyme remains unchanged and can repeat the process with more substrate. The more



enzyme you have, the more active sites there are to do this, so the faster the reaction. Also the more substrate you have, the less likely it is that some active sites will be idle, so up to a point, adding more substrate will speed up the reaction.

This process only works because the active site is a particular shape which is complementary to the substrate. Anything which changes the shape of the active site, means that the substrate cannot lock into it and therefore the rate of the reaction slows down or even stops.

Temperature is one such factor. At a certain temperature, the heat energy causes changes in the enzyme which alter the active site shape. This is called denaturation. Enzymes are designed to work best at a particular temperature called the optimum temperature.

pH can also have the same effect. Each enzyme is designed to work at a particular pH and if the environment becomes too acidic or alkaline, the enzyme will denature.

Enzymes

Proteins are made of long chains of a_____ a_____.

One example of proteins are e_____ that act as c_____.

The long chains of amino acids fold into highly s_____ 3-D shapes.

These complex 3-D shapes are what make up **ENZYME** molecules.

Each protein has its own number and sequence of amino acids. This gives each protein molecule a particular shape, allowing it to carry out a particular function).

It makes a unique SHAPE called the A_____ S_____,

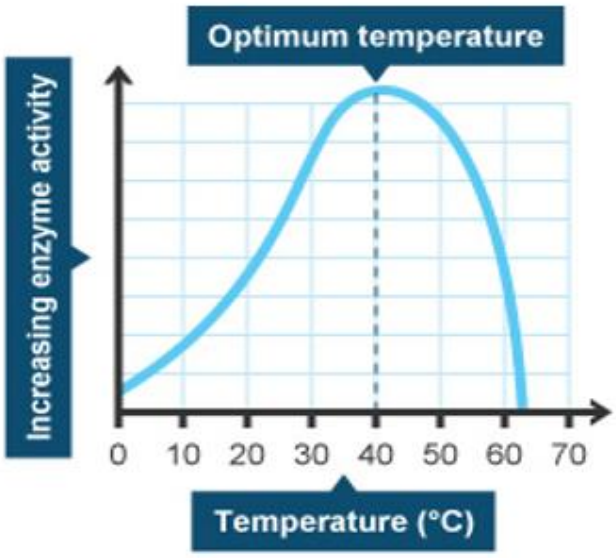
Only molecules with exactly the right shape will bind to the enzyme and react.

Lock and key theory

Enzymes have a specific 3D structure

They exactly match the shape of a molecule of substrate

Enzymes and Temperature



Low temperature:

Low temperature = low collision rate between the enzyme and substrate. Less collisions = less reactions!

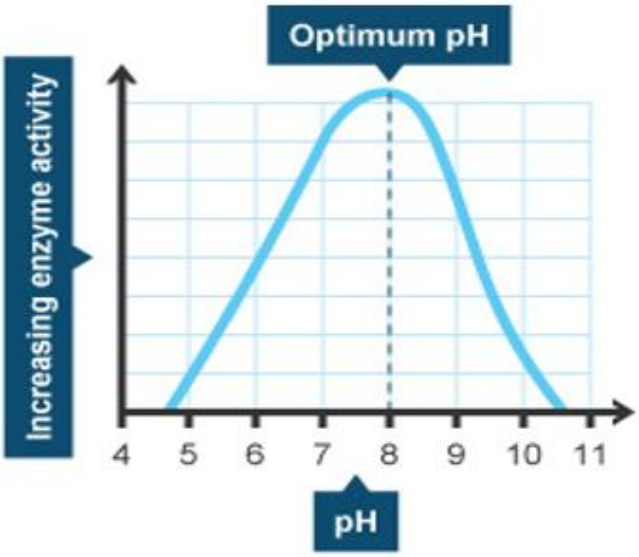
Optimum temperature:

Optimum temperature = the reaction goes at its fastest rate! The optimum temperature for human enzymes is 37°C

High temperature:

High temperature = The enzyme is **DENATURED**. This means that the **active site changes shape** and can no longer fit with the substrate. The enzyme can't function and the reaction stops. This is irreversible.

Enzymes and pH



Low pH:

Low pH = Enzyme is denatured. The shape of the active site changes and the substrate can no longer fit.

Optimum pH:

Optimum pH = normally this is pH7 but There are some enzymes which like acidic conditions, e.g. stomach enzymes which work at pH2.

High pH:

High pH = Enzyme is denatured. The shape of the active site changes and the substrate can no longer fit.

Enzymes and Temperature

As the temperature increases, the substrate and enzyme obtain more …….

This leads to them having more ……., leading to an increase in the

…… of the …….. As the temperature increases further, the rate will

reach a ……

If the temperature increases too much, the weak …….. that hold the enzyme

together, …….. This then changes the …….. of the enzyme's

…….. …….. The substrate can no longer fit and the rate of the

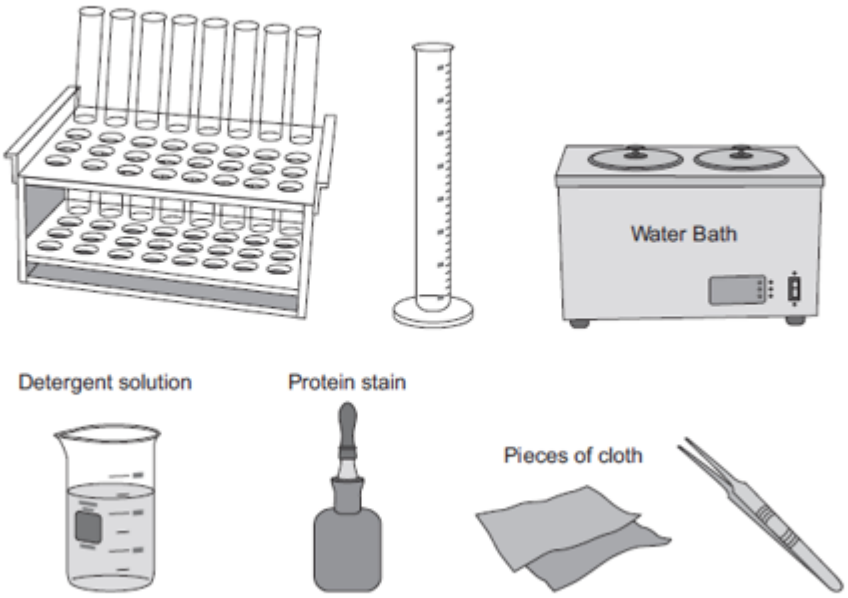
reaction …….. down and eventually ……

Reaction	bonds	energy	slows	active site	rate
Stops	shape	maximum	collisions	break	

Lesson – Exam Questions

Q1. Biological detergents contain protease enzymes.

(a) The drawings show some apparatus and materials.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how you would use the apparatus and materials shown in the drawings to find the best temperature for removing stains from clothing.

You should include how you would make the investigation a fair test.

.....

.....

.....

.....

.....

.....

.....

.....

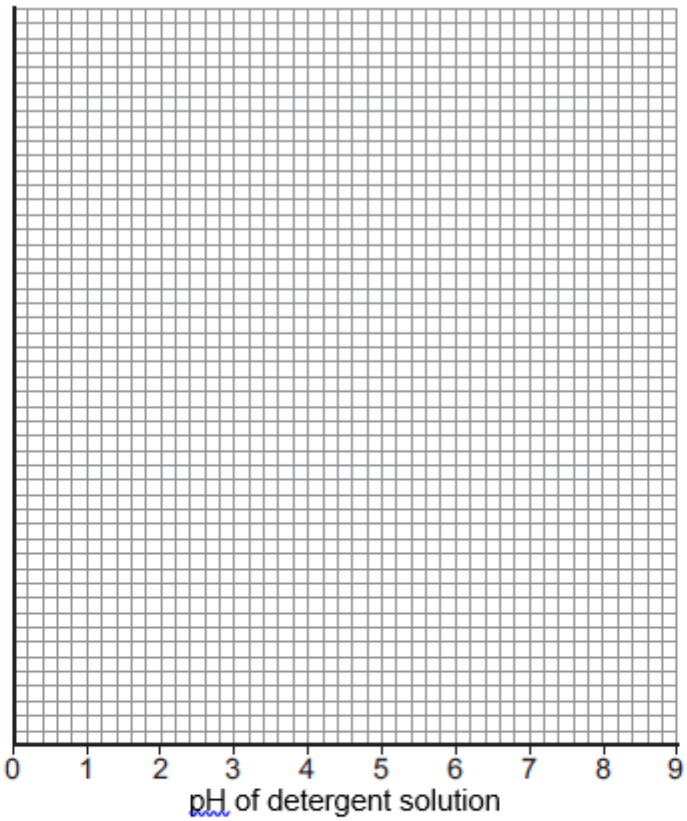
(b) In a similar investigation a student investigated the effect of pH on the time taken to remove a stain from pieces of cloth.

The table shows the student's results.

	pH of detergent solution								
	1	2	3	4	5	6	7	8	9
Time taken to remove stain in minutes	20	19	17	14	10	4	8	12	16

(i) On the graph paper below draw a graph to show the student's results.

- Add a suitable scale and label to the y axis.
- Plot the student's results.
- Draw a line of best fit.



(4)

(ii) Which is the best pH for using the detergent?

pH .....

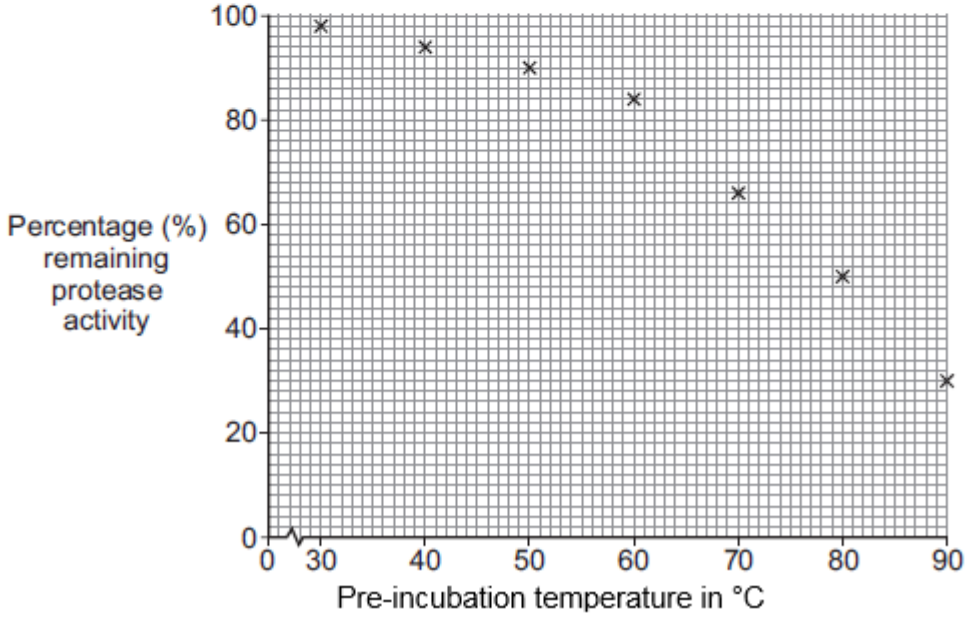
(1)

(c) Scientists investigated the stability of a protease enzyme. The protease enzyme was extracted from plants.

The scientists:

- pre-incubated samples of the enzyme at various temperatures for 30 minutes
- put each sample on ice for a further 10 minutes
- measured the percentage (%) remaining activity of the enzyme in each sample. This was done by incubating each sample with protein at 37 °C for 6 hours.

The graph shows the scientists' results.



The scientists recommended that the enzyme could be used in detergents at a temperature of 60 °C.

Suggest why the scientists recommended a temperature of 60 °C.
Use information from the graph and your own scientific knowledge in your answer.

.....

.....

.....

.....

.....

.....

(3)

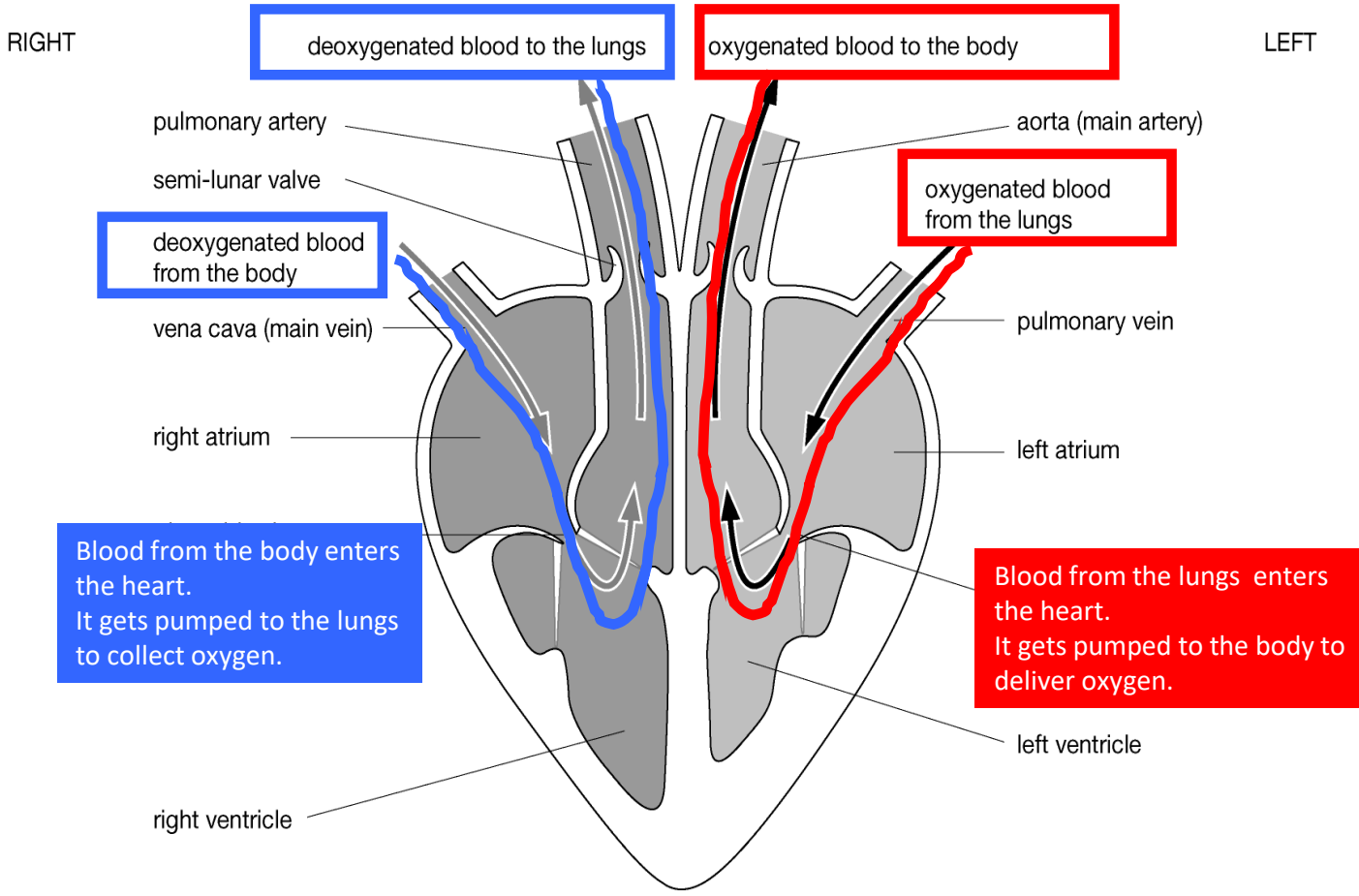
Lesson 6 – Circulatory System

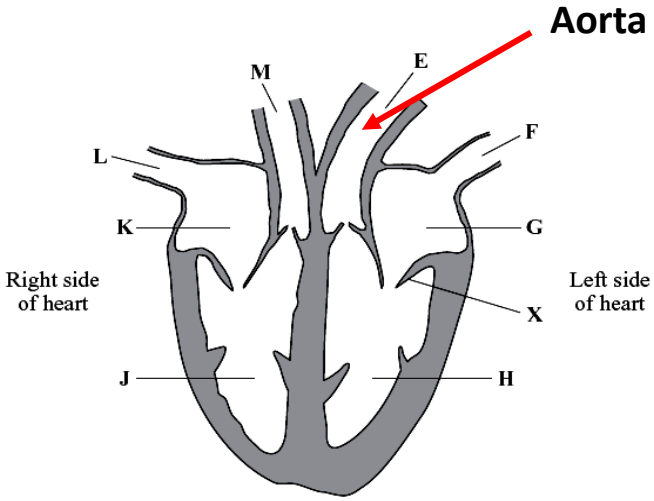
4.2.2.2 The heart and blood vessels

Content	Key opportunities for skills development
Students should know the structure and functioning of the human heart and lungs, including how lungs are adapted for gaseous exchange.	
The heart is an organ that pumps blood around the body in a double circulatory system. The right ventricle pumps blood to the lungs where gas exchange takes place. The left ventricle pumps blood around the rest of the body.	
Knowledge of the blood vessels associated with the heart is limited to the aorta, vena cava, pulmonary artery, pulmonary vein and coronary arteries. Knowledge of the names of the heart valves is not required.	https://www.youtube.com/watch?v=bpYaKM2hVFY
The natural resting heart rate is controlled by a group of cells located in the right atrium that act as a pacemaker. Artificial pacemakers are electrical devices used to correct irregularities in the heart rate.	

- Your heart beats about 100,000 times a _____ and about 35 million times a _____.
- In an average _____ the heart pumps about 1 million barrels of blood – 3 super tankers full.
- In 1 day blood travels 19000 ___
- The pressure the heart exerts as it contracts is about the same pressure that you would need to exert to squeeze a _____ ball.

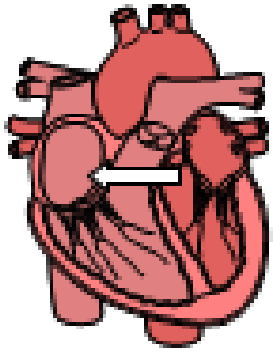
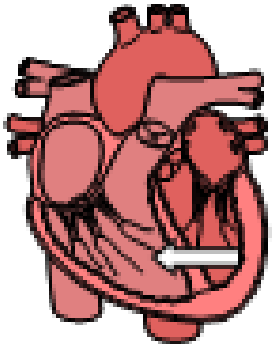
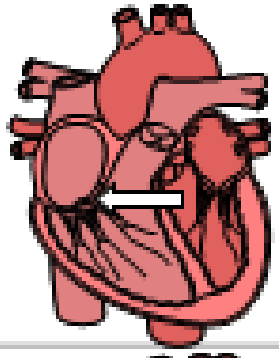
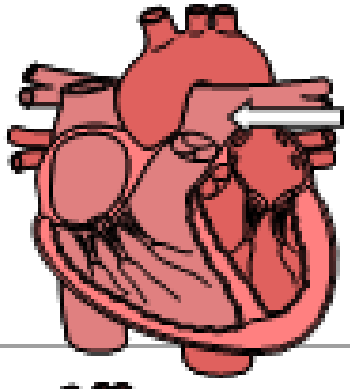
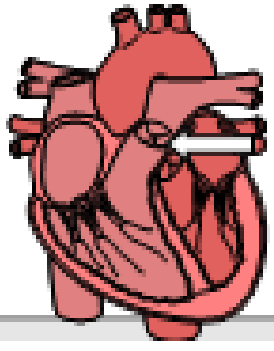
The structure of the heart

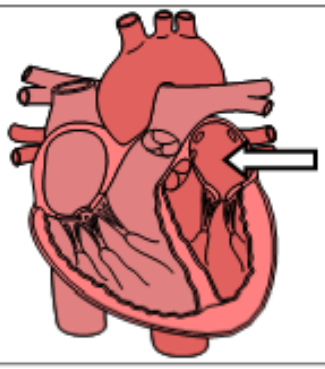
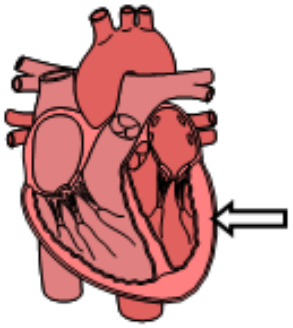
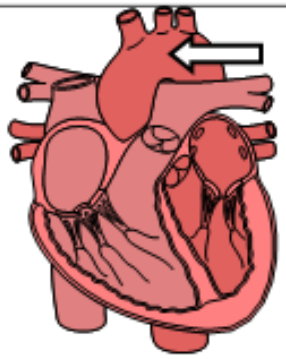




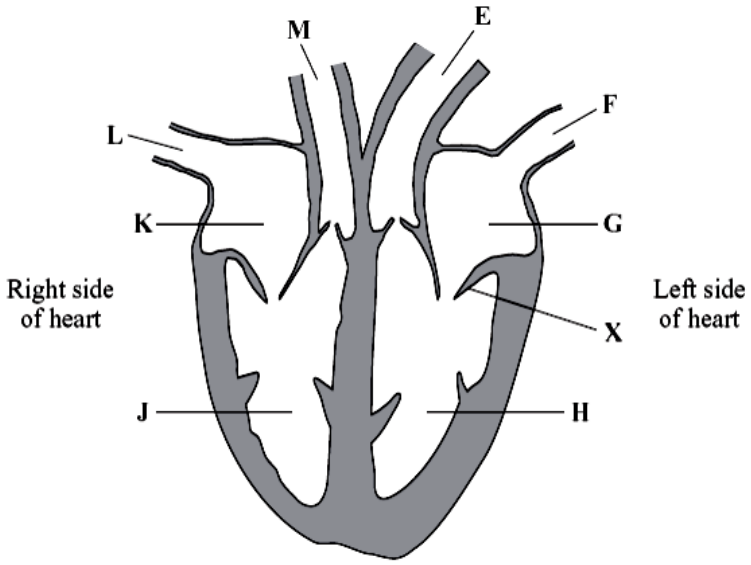
The heart receives its own supply of blood from the **coronary arteries**.

Two major **coronary arteries** branch off from the aorta near the point where the aorta and the left ventricle meet. These **arteries** and their branches supply all parts of the heart muscle with blood.

	**Right Atrium** Blood is brought back to the heart via the veins, where it arrives at the right atrium. The natural resting heart rate is controlled by a group of cells located in the right atrium that acts as a pacemaker.
	**Right Ventricle** Blood is pumped from the right ventricle to the lungs to be oxygenated.
	**Tricuspid Valve** As the Right Ventricle contracts, this valve closes to prevent the blood being pumped into the atrium, instead the blood goes into the pulmonary artery.
	**Pulmonary Artery** Blood leaves the right ventricle via the pulmonary artery. This is the only artery in the body that carries deoxygenated blood.
	**Pulmonary Valve** This valve stops blood that is being pumped to the lungs flowing back into the heart.

	**Left Atrium** Oxygenated blood that is returning from the lungs, arrives at the Left Atrium
	**Left Ventricle** Blood is pumped from the Left Ventricle around the body. The wall of the left ventricle is **bigger** than that of the right as the left pumps blood **further** and so needs a **greater force** giving a **higher pressure**
	**Aorta** As the Left Ventricle contracts, this valve closes to prevent the blood being pumped into the atrium, instead the blood goes into the Aorta. The blood leaves the left ventricle through the Aorta.

Label the diagram:



The circulatory system is an organ system composed of the **heart**, together with all of the **blood vessels** and the **blood**.
Its function is to **supply all of the cells with the food and oxygen** that have been absorbed at the exchange surfaces we have been looking at.

This allows the cells to continue to **respire** and perform the processes which keep you alive.

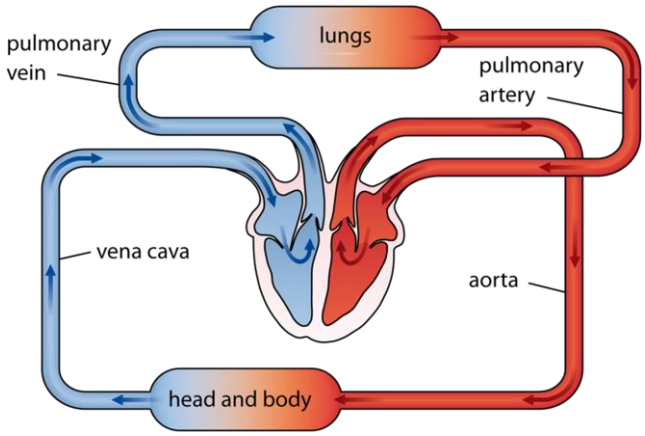
The heart forms the pump for this system, pumping the blood which is transporting the materials we need and the waste products we need to get rid off.

The heart does a double pump because we have a **double circulatory system**

The **RIGHT** side of the heart pumps deoxygenated (low oxygen) blood to the **lungs**, where it picks up oxygen.

The **LEFT** side of the heart pumps the freshly oxygenated blood around the **body** to all of the cells that require the oxygen.

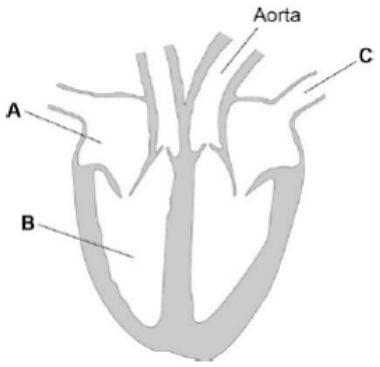
The blood passes through the heart **twice** in order to pass round both of these circulation systems.



Lesson 6 – Exam Questions

1 **Figure 1** shows a diagram of the human heart.

Figure 1



(a) Name parts **A** and **B**.

A _____

B _____

(2)

(b) What is the function of blood vessel **C**?

Tick **one** box.

To take blood from the heart around the body	☐
To take blood from the body to the heart	☐
To take blood from the heart to the lungs	☐
To take blood from the lungs to the heart	☐

(1)

2 The circulatory system transports substances such as glucose and oxygen around the body.

(a) Name **two** other substances that the circulatory system transports around the body.

1. _____

2. _____

(2)

(b) (i) Blood is a tissue. Blood contains red blood cells and white blood cells.

Name **two** other components of blood.

1. _____

2. _____

(2)

(ii) The heart is part of the circulatory system.

What type of tissue is the wall of the heart made of?

_____

(1)

(c) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Every year, many patients need to have heart valve replacements.

The table gives information about two types of heart valve.

Living human heart valve	Cow tissue heart valve
• It has been used for transplants for more than 12 years. • It can take many years to find a suitable human donor. • It is transplanted during an operation after a donor has been found. • During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted.	• It has been used since 2011. • It is made from the artery tissue of a cow. • It is attached to a stent and inserted inside the existing faulty valve. • A doctor inserts the stent into a blood vessel in the leg and pushes it through the blood vessel to the heart.

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve.

Use information from the table and your own knowledge in your answer.

_____

_____

_____

_____

_____

_____

_____

_____

Lesson 7 – Respiratory System

4.2.2.2 The heart and blood vessels

Content	Key opportunities for skills development
Students should know the structure and functioning of the human heart and lungs, including how lungs are adapted for gaseous exchange.	
Knowledge of the lungs is restricted to the trachea, bronchi, alveoli and the capillary network surrounding the alveoli.	

Starter:

Why do we need to respire?

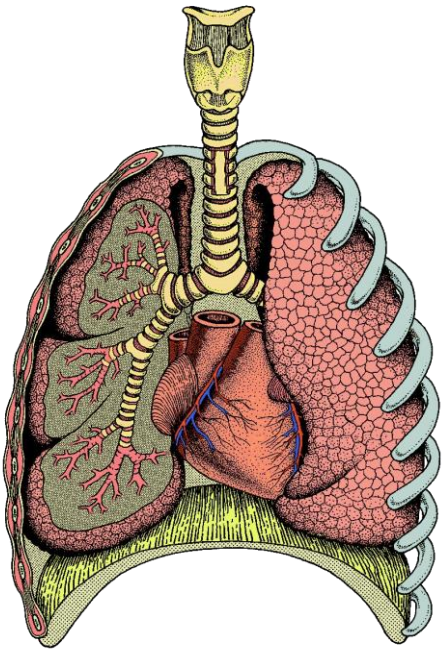
Where does respiration occur?

https://www.youtube.com/watch?v=aPUPfzsqDgs

Label the diagram:

Key words:

- **Alveoli**
- **Bronchi**
- **Bronchioles**
- **Diaphragm**
- **Intercostal muscles**
- **Lung**
- **Rib**
- **Trachea**



The human respiratory system is adapted to allow air to pass in and out of the body, and for efficient gas exchange to happen.
The lungs are enclosed in the **thorax**, surrounded and protected by 12 pairs of ribs. The ribs are moved by two sets of **intercostal muscles** . There is a muscular diaphragm below the lungs. The lungs are sealed within two airtight **pleural membranes**. These wrap around the lungs and line the rib cage.
The **trachea**, or windpipe, branches into two **bronchi** – one bronchus to each lung. Rings of **cartilage** in the walls of the trachea help to keep it open as air is drawn in.
The bronchi split into smaller branches and then into smaller tubes called **bronchioles**. Each bronchiole ends in a cluster of microscopic air sacs called **alveoli**.

Watch the video and answer the questions below:

https://www.bbc.co.uk/bitesize/clips/zxsnvcw

1- What happens when we breathe in?

Intercostal muscles-

Diaphragm-

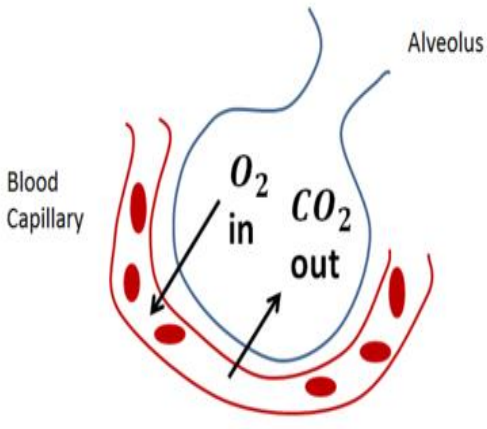
2- What happens when we breathe out?

Intercostal muscles-

Diaphragm-

Gas Exchange:

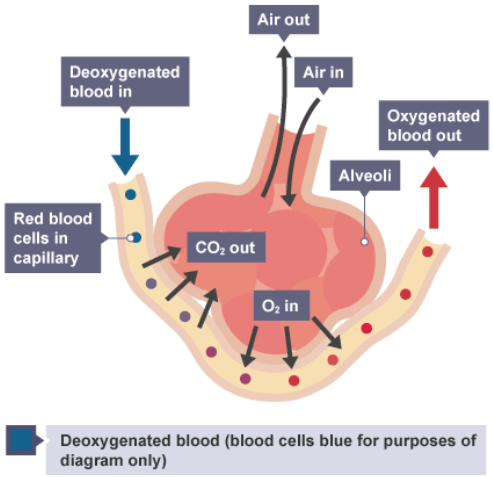
- Gas exchange is the process in which oxygen and carbon dioxide move between the lungs and the blood.
- It occurs in the alveoli. Through the process of diffusion oxygen and carbon dioxide are exchanged between the blood capillary network that surrounds them, and the alveoli.



The gases move in and out of the lungs by **diffusion**.

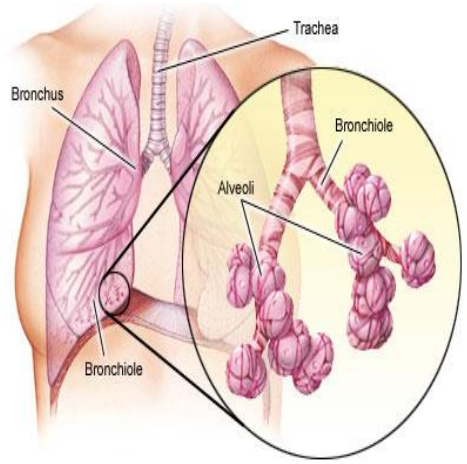
Diffusion is the process by where gases move from a high concentration to a low concentration: Oxygen diffuses from the air in the alveoli into the blood.

Carbon dioxide diffuses from the blood into the air in the alveoli.



Gas exchange occurs in tiny air sacs called the alveoli. Oxygen diffuses from the lungs into the blood and is carried to the cells to be used in respiration to create energy from glucose.
Carbon dioxide, released as a waste product from respiration diffuses from the blood into the lungs and is breathed out.

The **alveoli** are adapted to make gas exchange in lungs happen easily and efficiently.



Features of the alveoli that allow gas exchange:
- They have moist, thin walls (just one cell thick).
- They give the lungs a really big surface area.
- They have a lot of tiny blood vessels called capillaries which constantly takes the oxygen to the muscles and returns with carbon dioxide.

1. Where does gas exchange occur?

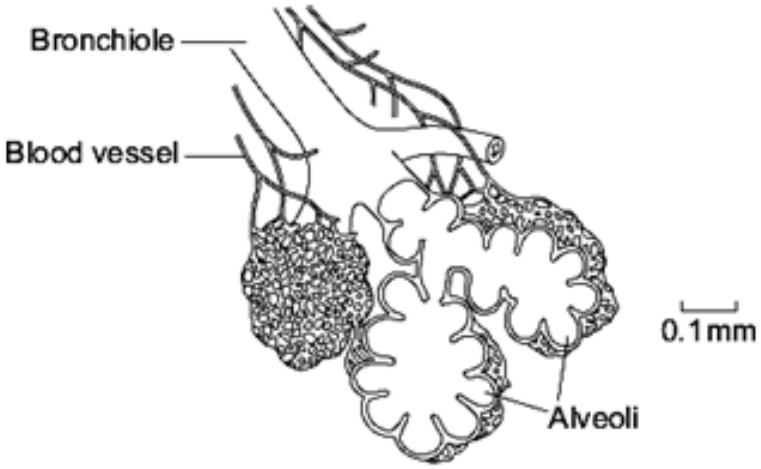
2. How are the alveoli adapted to allow gas exchange to occur?

3. What is the name of the process by which gases move in and out of the lungs?

4. Can you explain how this process works?

Lesson 7 – Exam Questions

Q1. The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



(a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1 .....

.....

2 .....

.....

3 .....

.....

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

.....

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

Explain how breathing does this.

.....

.....

.....

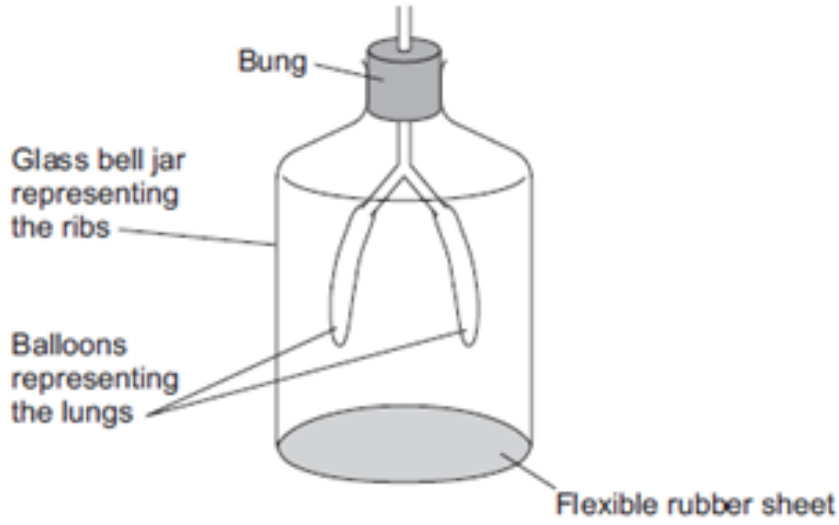
.....

(2)
(Total 6 marks)

Q2.Figure 1 shows a model representing the human breathing system.

The different parts of the model represent different parts of the human breathing system.

Figure 1



(a) (i) Which part of the human breathing system does the flexible rubber sheet represent?

.....

(1)

(ii) Explain why the balloons inflate when the flexible rubber sheet is pulled down.

.....

.....

.....

.....

.....

.....

(3)

Write down if the following statements are **true** or **false**:

1- Gas exchange occurs in tiny air sacs called alveoli.

2- Oxygen passes from the blood into the lungs and carbon dioxide passes from the lungs into the blood.

3- The alveoli are specially adapted to allow gas exchange to occur quickly.

4- Gases move by the process of osmosis.

5- Diffusion occurs when gases move from a high concentration to a low concentration.

Lesson 8 – Blood

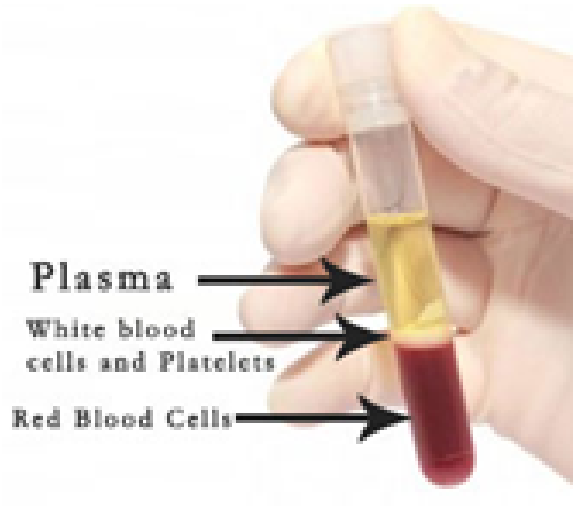
4.2.2.3 Blood

Content	Key opportunities for skills development
Blood is a tissue consisting of plasma, in which the red blood cells, white blood cells and platelets are suspended. Students should know the functions of each of these blood components.	AT 7 Observing and drawing blood cells seen under a microscope. WS 1.5 Evaluate risks related to use of blood products.
Students should be able to recognise different types of blood cells in a photograph or diagram, and explain how they are adapted to their functions.	WS 3.5
The body contains three different types of blood vessel: • arteries • veins • capillaries. Students should be able to explain how the structure of these vessels relates to their functions.	

https://www.youtube.com/watch?v=qrE6Y0Se8bw

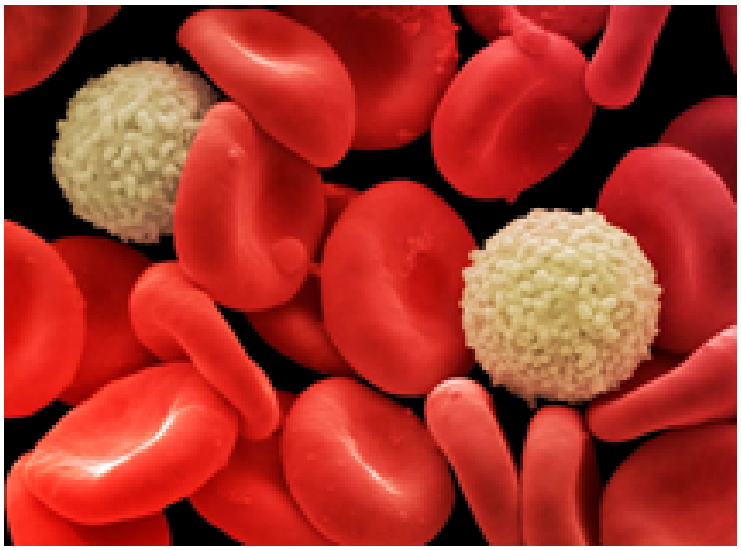
Match the correct part of the blood to its function.

Contains haemoglobin that the oxygen binds to be transported around the body.	Platelets
Transports dissolved substances such as water and glucose.	Red blood cells
Protects the body from disease.	Plasma
Helps the blood to clot.	White blood cell



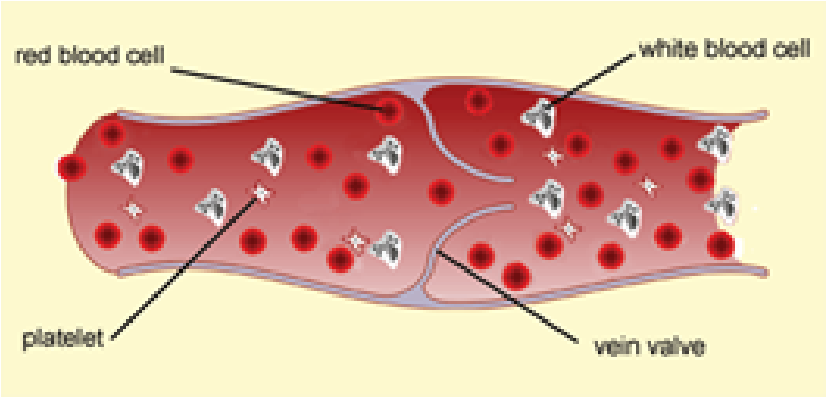
A human has 5 litres of blood in their body. Blood is made continually throughout your life in bone marrow tissue inside your bones Although it appears to be totally red, if you let it settle in a boiling tube, it separates into 2 layers.

The top layer appears yellow and watery – this is called blood plasma. Plasma is responsible for carrying around the red blood cells, white blood cells and platelets. It also carries soluble substances in it like hormones, antibodies, vitamins and minerals and digested food groups e.g. amino acids, glucose, fatty acids and glycerol. It also carries the waste substance carbon dioxide back to the lungs, and waste urea to the kidneys. It is good at doing this because it is mostly made of water.



The bottom layer is red and made of different types of cells and cell fragments. Most of these cells are red blood cells (about 5 billion per $1cm^3$ drop of blood), which contain a chemical called haemoglobin that allows them to pick up and carry oxygen around the body. When haemoglobin combines with oxygen, it forms oxyhaemoglobin. In the tissues, the oxygen is released and it is converted back to haemoglobin. Red blood cells are so packed full of this haemoglobin, that they have had their nucleus removed to make space. They also have a large surface area to maximise how much oxygen they absorb.

Blood is a liquid tissue whose function is to fight disease and to transport materials around the body. It consists of a straw-coloured liquid called **plasma**, with **red blood cells**, **white blood cells** and **platelets** floating in it.



Red Blood Cells

- Their job is to carry **oxygen** to all the cells in the body.
- They have a biconcave disc shape to give **maximum surface area** for absorbing **oxygen**.
- They contain **haemoglobin** which is very **red** and which contains **iron**. The function of haemoglobin is to carry oxygen to the body cells
- In the **lungs**, haemoglobin absorbs **oxygen** to become **oxy-haemoglobin**.
- In body tissues the reverse happens to release oxygen to the **cells**.
- Red blood cells have no need for a **nucleus**, so they **don't have one**, making **more room** for haemoglobin.

White Blood Cells

- Their main role is **defence against disease**.
- They have a **big nucleus**.
- White blood cells called **phagocytes** surround and digest unwelcome **micro-organisms**.
- White blood cells called **lymphocytes** produce **antibodies** to destroy bacteria and viruses. and **antitoxins** to neutralise the toxins produced by bacteria.

Plasma

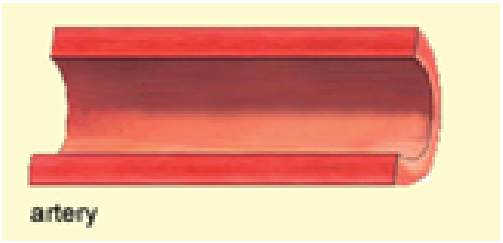
- This is a pale straw-coloured liquid which **carries**:
  - **Red** and **white blood cells** and **platelets**.
  - **Nutrients** like **glucose** and **amino acids**.
  - **Carbon dioxide**.
  - **Urea**.
  - **Hormones**.
  - **Antibodies** and **antitoxins** produced by the white blood cells.

Platelets

- These are **small fragments of cells**.
- They have **no nucleus**, because they are not whole cells.
- They help the blood to **clot** at a wound. This stops all your **blood pouring out** and stops **micro-organisms getting in**, so they are part of the body's natural defences against disease.

BLOOD VESSELS

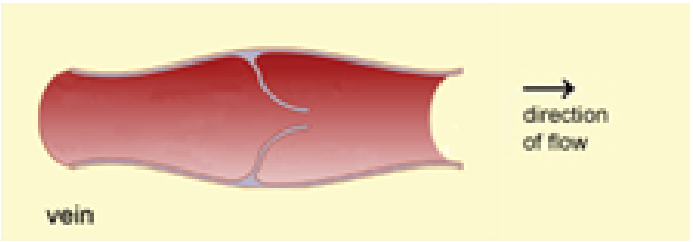
1 Arteries



- Arteries are thick-walled muscular tubes which carry blood **away from the heart**.
- This blood is usually **oxygenated**, except for the **pulmonary artery**, which takes deoxygenated blood to the lungs for gas exchange to take place.
- Blood comes out of the heart at **high pressure**, so arteries have **thick strong walls**.
- The artery leading from the heart to the rest of the body is called the **aorta**.

---

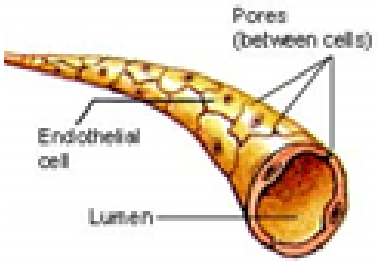
2 Veins

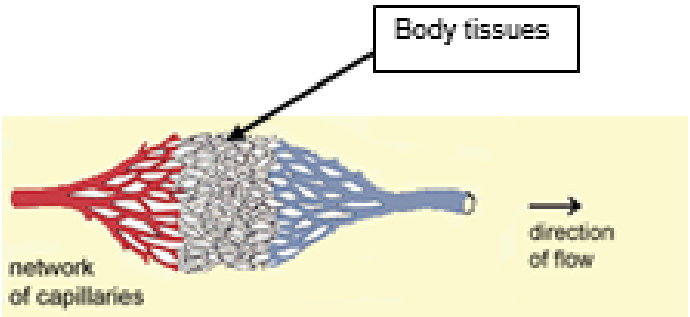


- Veins carry blood **back to the heart**.
- This blood is usually **deoxygenated**, except for the **pulmonary vein**, which takes oxygenated blood from the lungs to the heart, so that it can be pumped around the body.
- The blood is at **lower pressure** because it has been all through the body tissues, so the walls are **not as thick** as artery walls.
- Veins have a **larger lumen** (hole down the middle) to help blood flow.
- They also have **valves** to keep the blood flowing in the right direction.
- The large vein that goes into the heart from the body tissues is called the **vena cava**

---

3 Capillaries





- Capillaries are **very small blood vessels**.
- They go to **all** the body tissues.
- Their walls are just **one cell thick** - so thin that oxygen, nutrients and waste products can easily **diffuse** through them into and out of the tissue cells. White blood cells can also leave the capillaries to destroy bacteria and viruses in the body tissues.

1. What are the four components of blood?

2. How is the red blood cell adapted for its function?

3. How is the white blood cell adapted for its function?

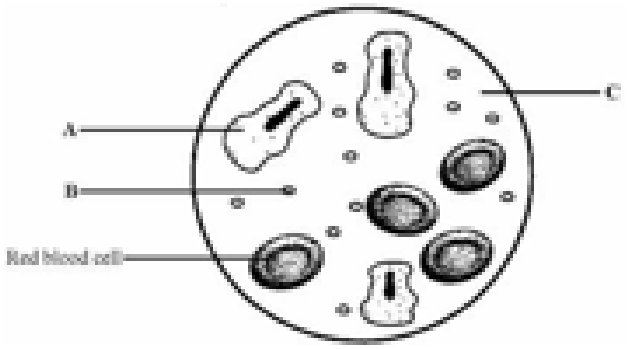
4. What sort of things are transported in plasma?

5. How do platelets work?

6. Describe how an artery is adapted to its function

Lesson – Exam Question

Q1. The diagram shows four parts of blood.



(a) Complete the table to give the name and function of the parts labelled A, B and C.

Letter	Name	Function
A	.....	....
B	.....	....
C	.....	....

(6)

Q2. (a) (i) Name the red pigment found in red blood cells.

.....

(1)

(ii) Describe, in detail, the function of this red pigment.

.....

.....

.....

.....

(2)

(b) Describe one other way in which the structure of a red blood cell is different from the structure of a white blood cell.

.....

.....

(1)

(Total 4 marks)

Lesson 9 – CHD

4.2.2.4 Coronary heart disease: a non-communicable disease

Content	Key opportunities for skills development
Students should be able to evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs, mechanical devices or transplant. In coronary heart disease layers of fatty material build up inside the coronary arteries, narrowing them. This reduces the flow of blood through the coronary arteries, resulting in a lack of oxygen for the heart muscle. Stents are used to keep the coronary arteries open. Statins are widely used to reduce blood cholesterol levels which slows down the rate of fatty material deposit. In some people heart valves may become faulty, preventing the valve from opening fully, or the heart valve might develop a leak. Students should understand the consequences of faulty valves. Faulty heart valves can be replaced using biological or mechanical valves. In the case of heart failure a donor heart, or heart and lungs can be transplanted. Artificial hearts are occasionally used to keep patients alive whilst waiting for a heart transplant, or to allow the heart to rest as an aid to recovery.	WS 1.4 WS 1.3 Evaluate methods of treatment bearing in mind the benefits and risks associated with the treatment. https://www.youtube.com/watch?v=5wSfCZESRHU

Watch the video and answer the questions:

1- What is CHD?

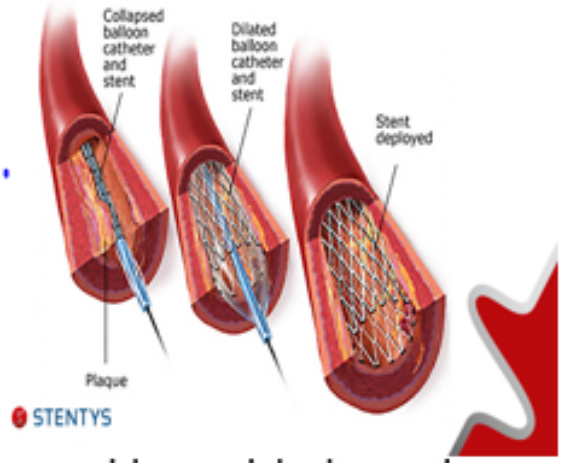
2- What does CHD cause?

3- What symptoms might you experience with CHD?

Challenge – *Name factors that may lead to a person developing CHD.*

Stents

Stents are metal grids which are placed inside the coronary artery and are used to keep it open. This allows the blood to keep flowing to the heart muscle.



The advantages of using stents are that they provide a quick alternative to other methods if the disease is not too serious.

However a disadvantage is that the layer of fat that causes CHD may build up over the stent in the future.

Statins

Statins are a drug that people with high cholesterol levels take. They help to reduce the amount of cholesterol in the blood and slow down the amount that builds up in our blood vessels.

It is the cholesterol that builds up in the arteries that causes Coronary Heart Disease.

The advantages of using statins are that they provide a quick alternative to other methods if the disease is not too serious.

However a disadvantage is that they have side effects such as liver and kidney problems. Scientists also don't know the long term affect of taking them for a long time.

Heart Transplant

In the most sever case a heart transplant can be made. This is where a healthy donor heart is transplanted into the patient.

The advantages of a heart transplant is that cardiovascular disease is treated completely and can restore health.

The disadvantages are that the procedure is complicated. The body could reject the donor heart and cause it to not work correctly. Infections can also occur.

Nitrates

- Nitrates cause the arteries to dilate (widen), meaning blood flows more easily
- This relieves the symptoms of angina (chest pain or pressure).
- Nitrates also dilate veins throughout the body so that they can hold more blood. This reduces the amount of blood going back to the heart, reducing the heart's workload.
- The side effects can include headaches and dizziness

Heart valve replacement

In some people the heart valves may become faulty. This prevents the valve from fully opening or the hear valve could develop a leak.

Faulty heart valves can be replaced.

Biological replacement - A donor donates a heart valve which is transplanted by surgery.

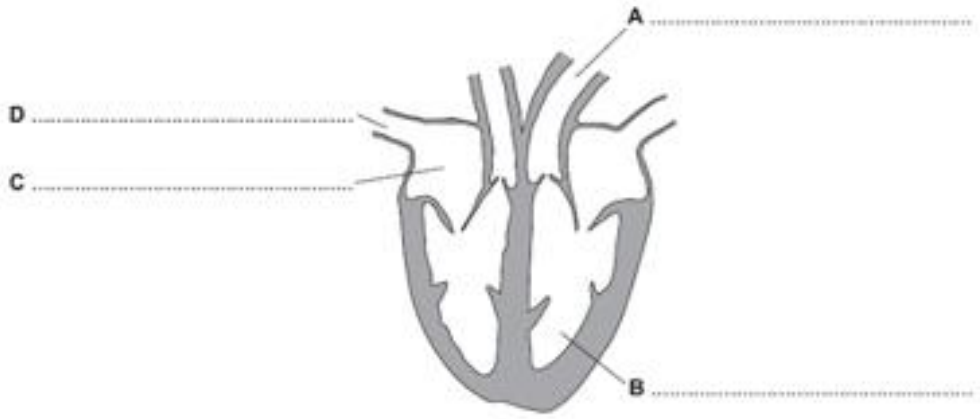
Mechanical replacement - artificial valve is inserted into the heart.

Method for treating CHD	How does it work?	Advantages	Disadvantages
Stents			
Statins			
Heart Transplant			
Nitrates			
Heart valve Replacement			

– Exam question

Q1.Diagram 1 shows a section through the heart.

Diagram 1



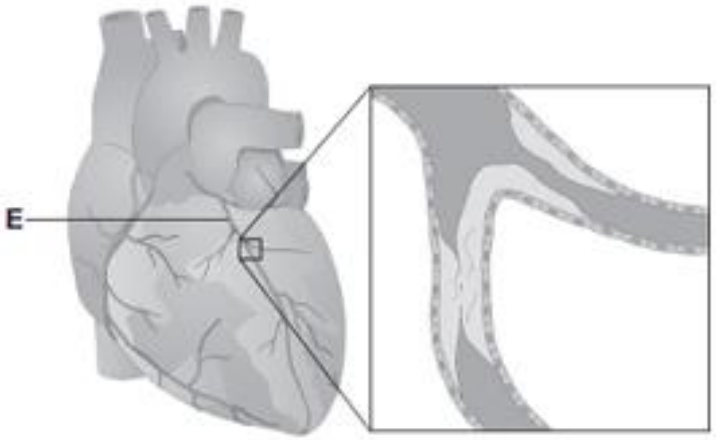
(a) On the diagram, name the parts labelled **A**, **B**, **C** and **D**.

(4)

(b) **Diagram 2** shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

Diagram 2



(i) Name blood vessel E.

.....

(1)

(ii) Give **one** method of treating the narrowed part of blood vessel E.

.....

(1)

(iii) Explain how the method of treatment works.

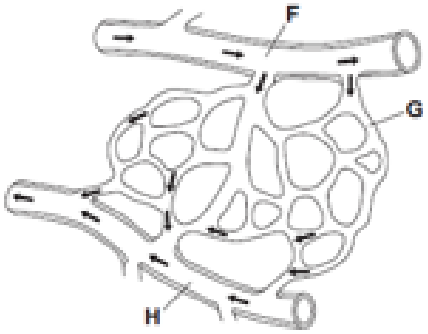
.....

.....

(2)

(c) **Diagram 3** shows part of the blood supply in the lungs.

Diagram 3



(i) Name the types of blood vessel labelled **F**, **G** and **H**.

F.....

G.....

H.....

(3)

(ii) Give **one** way in which the composition of the blood in vessel **F** is different from the composition of the blood in vessel **H**.

.....

.....

(1)

(Total 12 marks)

Decide if the statements below are true or false. Once you have decided can you correct the false statements to what they should say.

1- Stents are metal grids which are placed inside the veins to keep them open.

2- The disadvantage to stents are that a layer of fat can build up over the stent.

3- Statins are drugs that are used to treat high cholesterol levels.

4- Statins have no side effects are 100% safe.

5- Heart valves cannot be replaced once they have become faulty.

Lesson 10 – Lifestyle

4.2.2.5 Health issues

Content	Key opportunities for skills development
Students should be able to describe the relationship between health and disease and the interactions between different types of disease. Health is the state of physical and mental well-being. Diseases, both communicable and non-communicable, are major causes of ill health. Other factors including diet, stress and life situations may have a profound effect on both physical and mental health. Different types of disease may interact. • Defects in the immune system mean that an individual is more likely to suffer from infectious diseases. • Viruses living in cells can be the trigger for cancers. • Immune reactions initially caused by a pathogen can trigger allergies such as skin rashes and asthma. • Severe physical ill health can lead to depression and other mental illness.	
Students should be able to: • discuss the human and financial cost of these non-communicable diseases to an individual, a local community, a nation or globally • explain the effect of lifestyle factors including diet, alcohol and smoking on the incidence of non-communicable diseases at local, national and global levels.	WS 1.4
Risk factors are linked to an increased rate of a disease. They can be: • aspects of a person's lifestyle • substances in the person's body or environment. A causal mechanism has been proven for some risk factors, but not in others. • The effects of diet, smoking and exercise on cardiovascular disease. • Obesity as a risk factor for Type 2 diabetes. • The effect of alcohol on the liver and brain function. • The effect of smoking on lung disease and lung cancer. • The effects of smoking and alcohol on unborn babies. • Carcinogens, including ionising radiation, as risk factors in cancer. Many diseases are caused by the interaction of a number of factors.	WS 1.5 Interpret data about risk factors for specified diseases.

Starter Quiz:
Complete the how healthy are you quiz. Be honest in your answers!

Nutrition:

1. How many serves of fruit do you usually eat in a day, including fresh, canned and dried fruit?
a) none
b) one
c) two or more

2. How many serves of salad and vegetables do you usually eat in a day, including raw and cooked vegetables?
a) none
b) between one and three
c) four or more

3. How many snack foods – such as chips, chocolate or cake – do you usually eat in a day?
a) three or more a day
b) one to two a day
c) none

4. How many sugary drinks do you usually drink in a day, including cordial, fizzy drinks and fruit juice?
a) two or more a day
b) one to two a day
c) none

Physical activity:

5. How much moderate (breathing quicker than normal) or vigorous (huffing and puffing) exercise do you usually do in a day
a) 0 - 30 minutes
b) 30 - 60 minutes
c) 60 minutes or more

6. How often do you walk, cycle, skateboard or ride a scooter to school?
a) never
b) sometimes
c) most days

7. How often do you spend time doing active things with your family (like playing at home, walking the dog, cycling or swimming)?
a) never
b) once or twice a week or less
c) more than twice a week

8. How much time do you usually spend watching TV, playing computer games, reading or doing homework?
a) more than two hours a day
b) between one and two hours a day
c) no more than one hour a day

Health is defined as the state of **physical and mental wellbeing**. So being healthy means you are mentally as well as physically fit. Both physical and mental health can be maintained or improved by:

- a well-balanced diet
- regular exercise
- reducing stress
- seeking medical help for mental or physical difficulties.

Well-balanced diet

A well-balanced diet means that you have the correct amount of the key food groups. This is often shown in a food pyramid, as shown in Figure 4.28. Vegetables are low in fat, high in fibre and provide your body with key vitamins. Fruits have more natural sugar than vegetables do, but are also low in fat and high in fibre and vitamins. Fats should only be consumed in lower quantities and are found in fish and nuts as well as many processed foods. Dairy products include milk, yoghurt and cheese. These are high in protein and some vitamins but also high

▲ **Figure 4.28** A balanced diet represented as a food pyramid.

in fats and cholesterol. Recent research suggests that the negative effects of dairy foods can outweigh the benefits such as strengthening bones. Meat and beans are a good source of protein as well as vitamins and minerals. Some scientists think that the food pyramid is an oversimplification, whilst others think that it is a useful guide for the public.

Regular exercise

The National Health Service (NHS) in the UK recommends that young people (aged 5 to 18) undertake at least 1 hour of physical activity every day. Some of this should be moderate intensity such as cycling and playground activities. Other activity should be vigorous, such as fast running and tennis. On 3 days a week this should involve muscle-strengthening exercise such as push-ups, and bone-strengthening activities such as running. Exercise also improves the effectiveness of your circulatory system.

Physical and mental ill health

Diseases can cause ill health. Some **different types of disease can interact** to cause health problems. Problems with a person's **immune system** might mean they are more likely to suffer from communicable diseases. A small number of specific virus infections can lead to the development of cancer. The reactions of a person's immune system to infection from a pathogen can trigger allergies such as skin rashes and asthma. Severe physical ill health can lead to mental ill health, such as stress, anxiety and depression.

Stress is the feeling of being under too much mental or emotional pressure. This can affect how you feel, think and behave. It is common for people who are stressed to sleep badly, lose their appetite and have difficulties concentrating. **Anxiety** is a feeling of unease, which might be worry or fear. This can be mild or severe depending upon the situation and the person. **Depression** affects different people in many different ways. Some people feel sad or hopeless, others lose interest in things they used to enjoy. Depression can also affect your physical health. It can make you feel tired and also lose your appetite. Severe depression can make people feel suicidal. People who feel stressed, anxious or depressed should speak to their doctor as soon as possible.

1. What four things improve both physical and mental health?

2. What is a well-balanced diet?

3. How much exercise does the NHS recommend people aged 5-18 take?

4. A small number of what can lead to cancer?

5. What can severe physical ill health lead to?

6. What is stress?

7. What is anxiety?

8. How does depression affect people?

Diseases can be grouped into 2 types:

Communicable diseases can be easily spread from person to person, EG: coughing, body fluid.

- They are usually found in the form of bacteria and viruses.
- Some examples of communicable diseases are HIV and Aids, Flu, Malaria, TB.

https://www.youtube.com/watch?v=QYWNXp36O48

Non- Communicable diseases are a group of specific conditions; which are not transferred between people or other organisms

They often require long term treatment and care. They can be prevented by reducing common risk factors such as our lifestyle choices.

Some examples of non- communicable diseases are Cancer, diabetes, lung diseases, CHD, neurological disorders.

Other factors that can have major effects on physical and mental health include:

- **diet**
- **lifestyle factors such as alcohol and other drugs**
- **stress**
- **situations that may occur in a person's life**

Task: Complete the mind map of risk factors which can increase your chance of developing a non-communicable disease.

https://www.youtube.com/watch?v=H6DrSG_KQjo

Exam Question

Diet and exercise affect health.

(a) Many people are obese (very overweight).

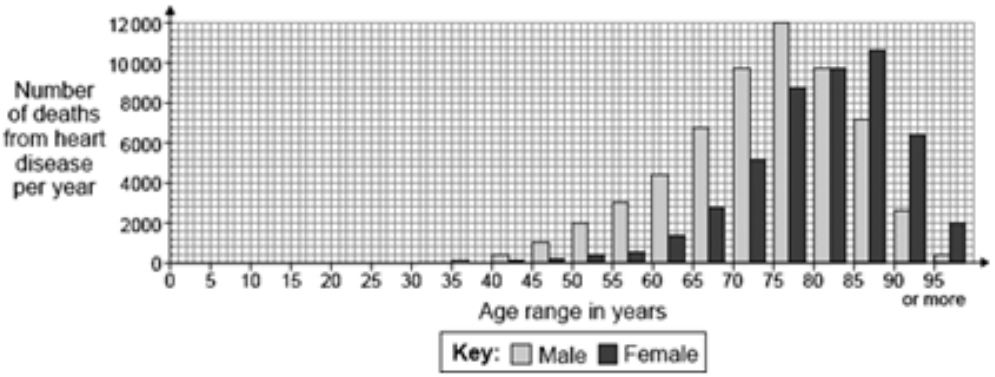
Obesity can lead to heart disease.

Other than heart disease, name **two** conditions which are linked to obesity.

1 .....

2 .....

(b) The graph shows the number of deaths from heart disease each year in the UK.



The pattern for deaths from heart disease in men is different from the pattern in women.

(i) Give **two** differences between the patterns for men and women.

1 .....

.....

2 .....

.....

(ii) Suggest **two** reasons for the difference in the number of deaths from heart disease in men and women between the ages of 40 and 60.

1 .....

.....

2 .....

Past paper question High demand

The concentration of cholesterol in the blood affects people's health.

(a) Give **two** factors that affect the concentration of cholesterol in the blood.

1 .....

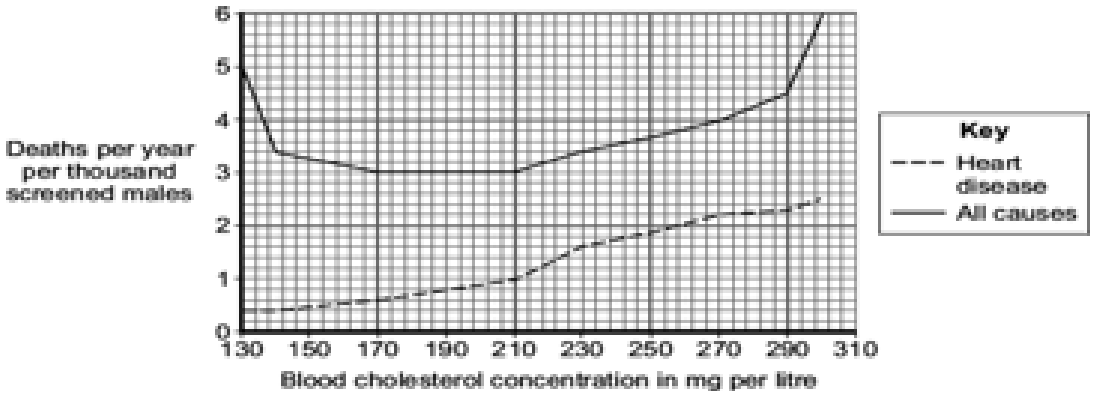
2 .....

(2)

(b) Doctors screened men for blood cholesterol concentration.

The doctors then compared death rates from heart disease with deaths from all causes in this screened group.

The graph shows the results.



(i) Which is the best conclusion that can be drawn from the data?

Tick (✓) **one** box.

There is a positive correlation between blood cholesterol concentration and deaths from all causes. ☐

There is a negative correlation between blood cholesterol concentration and deaths from all causes. ☐

Blood cholesterol concentration is only one of several factors affecting death from all causes. ☐

(1)

(ii) Based on the data in the graph **only**, which is the ideal range for blood cholesterol concentration?

Range ..... to..... mg cholesterol per litre.

(1)(Total 4 marks)

Lesson 11 – Cancer

4.2.2.7 Cancer

Content	Key opportunities for skills development
Students should be able to describe cancer as the result of changes in cells that lead to uncontrolled growth and division. Benign tumours are growths of abnormal cells which are contained in one area, usually within a membrane. They do not invade other parts of the body. Malignant tumour cells are cancers. They invade neighbouring tissues and spread to different parts of the body in the blood where they form secondary tumours. Scientists have identified lifestyle risk factors for various types of cancer. There are also genetic risk factors for some cancers.	

Additional Notes:

https://www.youtube.com/watch?v=SGaQ0WwZ_0I

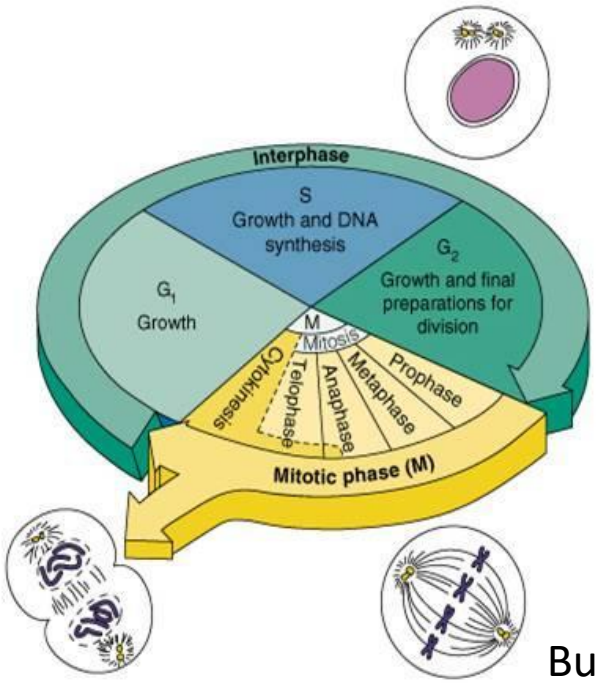
There are around **200** types of cell in the human body. Many of these can become cancerous.
There are more than 100 types of cancer. Types of cancer are usually named for the organs or tissues where the cancers form, but they also may be described by the type of cell that formed them.

Cells in your body live for a different lengths of time:

- A red blood cell lives for about 4 months
- A white blood cell lives for about a year
- A skin cell lives for about 2 or 3 weeks
- Colon cells live for about 4 days
- Sperm cells live for about 3 days
- Some brain cells typically last an entire lifetime (neurons in the cerebral cortex, for example, are not replaced when they die.)

https://www.youtube.com/watch?v=-OZAcSu3d8M

Because cells die we need to be able to make new ones.

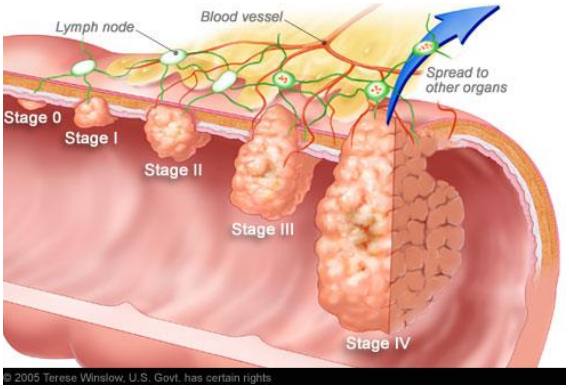


Mitosis is a type of **cell division**.

Mitosis occurs wherever more cells are needed. It produces two new cells that are **identical** to each other, and to the parent cell.

The process of growth and division is called the **cell cycle**.

But sometimes this process goes wrong.



So the cell gets stuck in the replicating stage and makes more than one copy of itself. This results in uncontrolled growth can cell division.

The tumours come in 2 forms…

Benign	*Malignant*

How does cancer spread?

When cancer cells break away from a tumour, they can travel to other parts of the body through the bloodstream or the lymph system.
(Lymph vessels are much like blood vessels, except they carry a clear fluid and immune system cells.)

List the risk factors?

Exam Questions

1 The number of people in the UK with tumours is increasing.

(a) (i) Describe how tumours form.

(1)

(ii) Tumours can be malignant or benign.

What is the difference between a malignant tumour and a benign tumour?

(1)

(b) Describe how some tumours may spread to other parts of the body.

_____

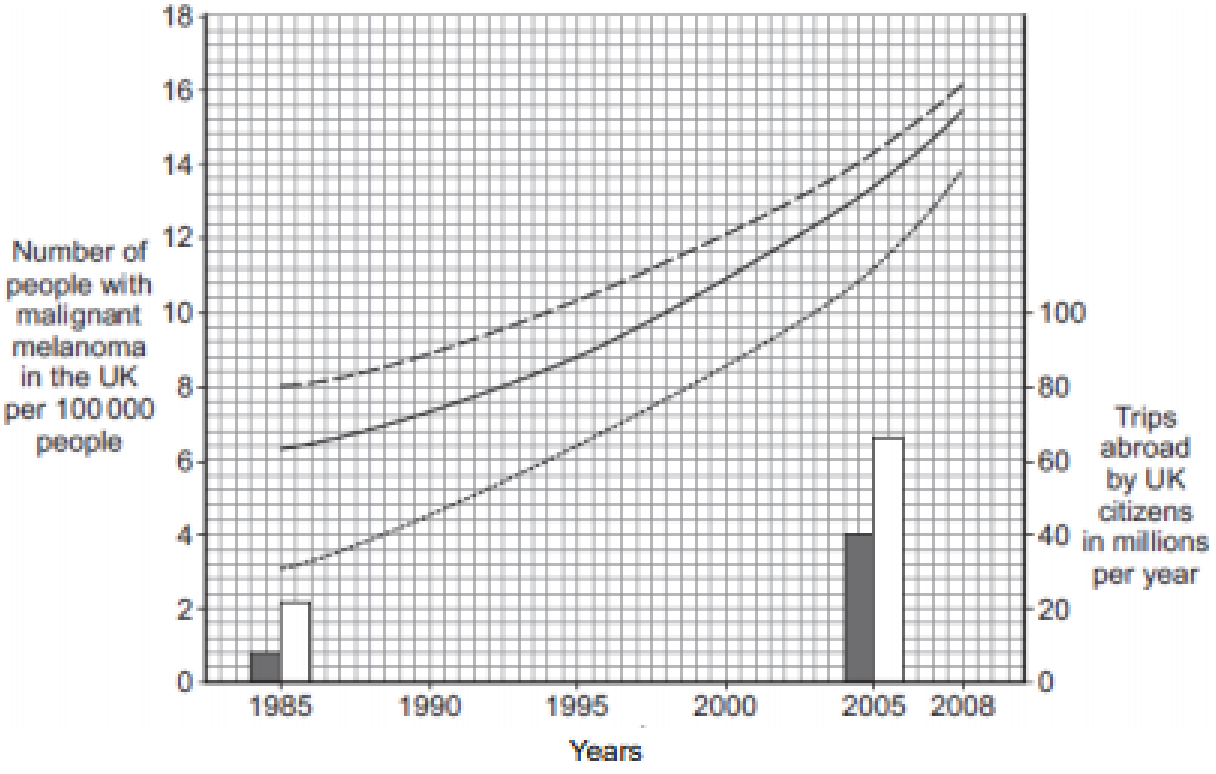
_____

(1)

(c) People from Northern Europe have fair skin and many people have malignant melanoma skin cancer.

The graph shows how the number of people in the UK with malignant melanoma changed between 1985 and 2008.

The bars on the graph show the number of people in the UK who travelled abroad and the number who took cheap holidays in the sun in 1985 and 2005.



Key

Mean for all areas

Mean for people from rich areas

Mean for people from poor areas

Total number of trips abroad

Number of cheap holidays in the sun

(i) Describe the trends in the number of people with malignant melanoma skin cancer between 1985 and 2008.

_____

_____

_____

_____

_____

_____

(3)

(ii) Use the data about the number of trips abroad to suggest an explanation for the trends you have described in part **(c)(i)**.

_____

_____

_____

_____

(2)

(Total 8 marks)

2 Malignant tumours are called cancers.

(a) Describe how a tumour can spread to different parts of the body.

_____

_____

_____

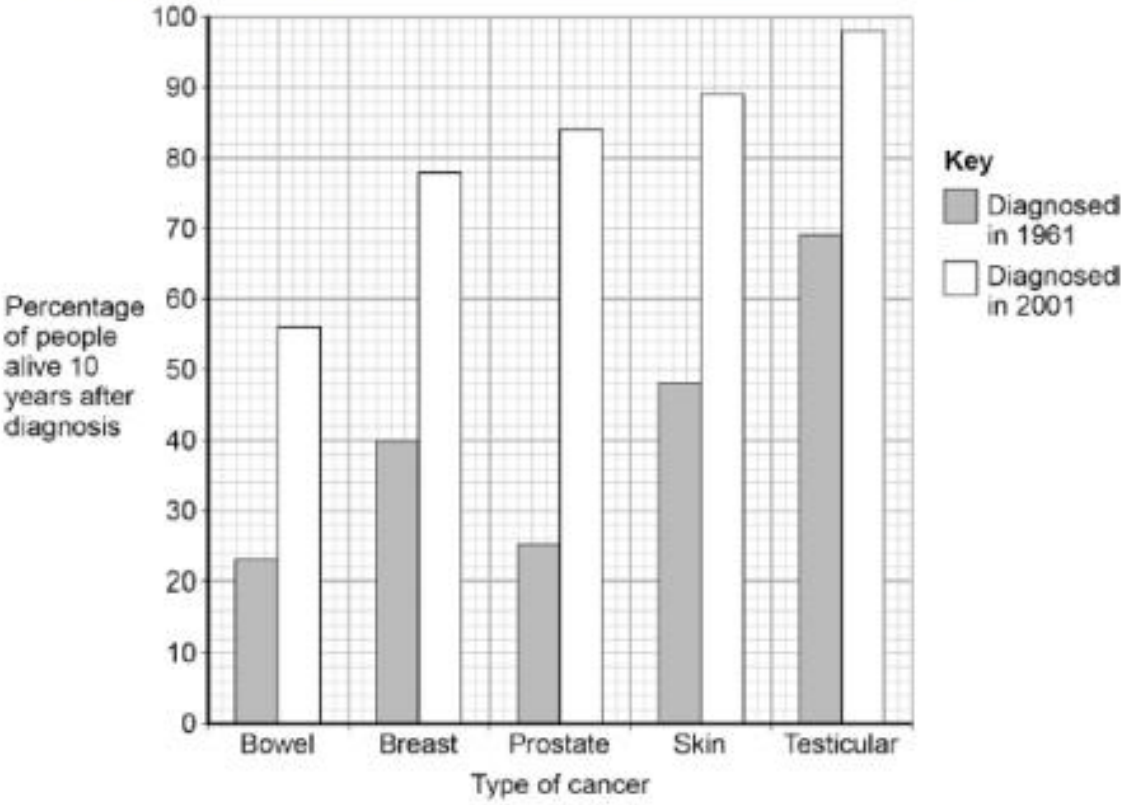
_____

(2)

(b) Survival rates for people with cancer have improved a lot.

Some people who are alive 10 years after diagnosis are considered to be cured.

The figure below shows data for people diagnosed with cancer in 1961 and 2001.



Look at the data in the figure above for skin cancer.

Calculate the percentage increase in the survival rate of people diagnosed with skin cancer in 1961 compared to 2001.

Give your answer to **three** significant figures.

_____

_____

Survival rate increase = _____ %

(2)

(c) Look at the data in the figure above for bowel and prostate cancer.

Compare the survival rates for bowel and prostate cancer.

Suggest reasons for the comparisons you have made.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Lesson 12 – Plant Organs

4.2.3.1 Plant tissues

Content	Key opportunities for skills development
Students should be able to explain how the structures of plant tissues are related to their functions. Plant tissues include: • epidermal tissues • palisade mesophyll • spongy mesophyll • xylem and phloem • meristem tissue found at the growing tips of shoots and roots. The leaf is a plant organ. Knowledge limited to epidermis, palisade and spongy mesophyll, xylem and phloem, and guard cells surrounding stomata.	AT 7 Observation and drawing of a transverse section of leaf.

Complete the table:

Plant Organs	Function	Specialisation
Flower		
Stem		
Root		
Leaf		

Plant organs are made up of different tissues.

Photosynthesis takes place in the leaves of plants.

The plants use energy from the sun to join carbon dioxide and water to form glucose (sugar).

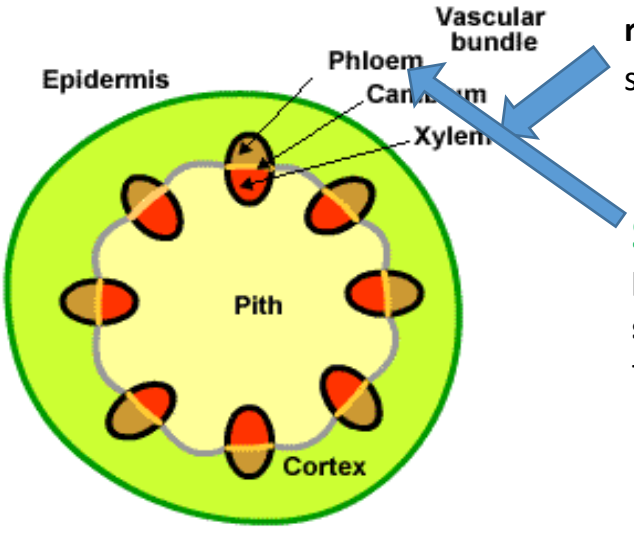
https://www.youtube.com/watch?v=2BR1zdMBhY4

Watch the video and answer the questions.

Describe the following:

- Upper Epidermis: _____
  _____
- Palisade Mesophyll: _____
  _____
- Spongy Mesophyll:
  _____

The leaves and the stem contains two important tissues, called the XYLEM and PHLOEM.



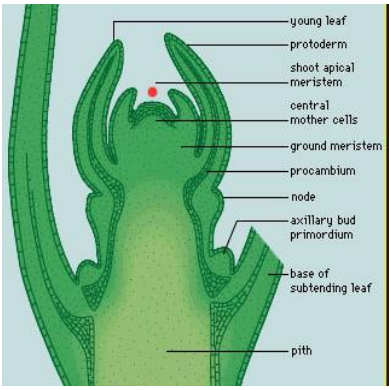
Water travels from **roots to leaves** up the stem in the **XYLEM**.

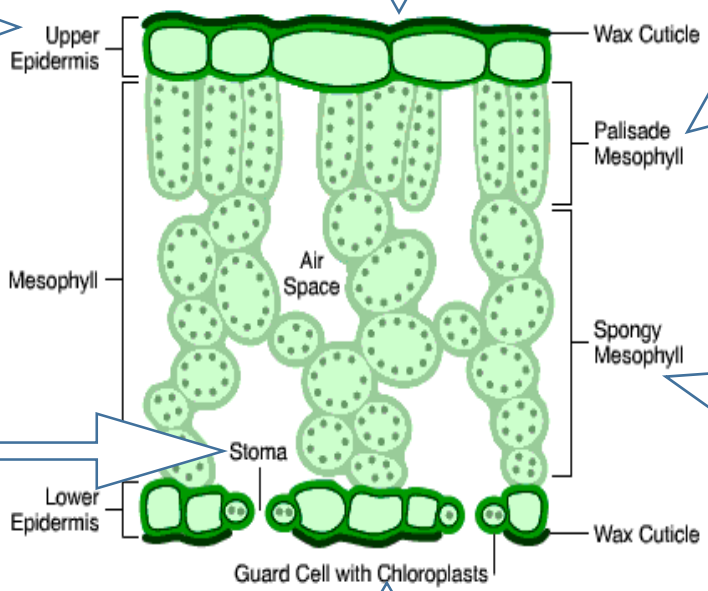
Sugar travels from **leaves to shoots** and **storage organs** down the stem in the **PHLOEM**.

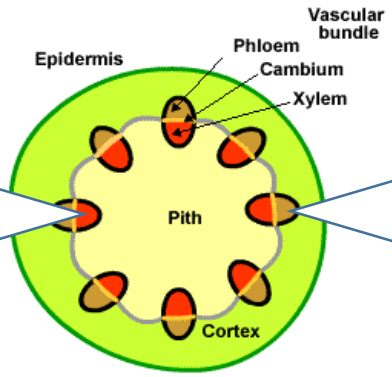
Plants cells are different to animal cells in another way. Unspecialised stem cells in plants are grouped together in structures called **meristems**. **Meristem tissues are found at the growing tips of shoots and roots.**

Cells produced by **meristems** ensure that plants continue to grow in height and width throughout their life. Animals stop growing in size once they become adults.

Plant **meristems** divide to produce cells that increase the height of the plant, length of the roots and girth of the stem. They also produce cells that develop into leaves and flowers.



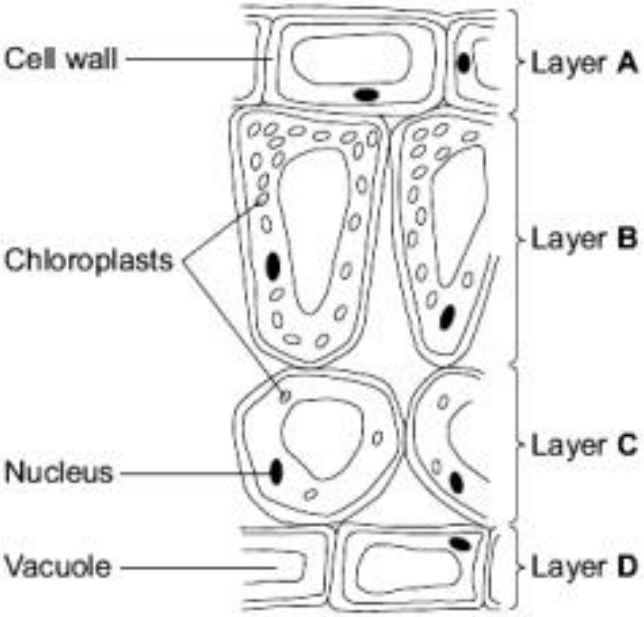

Upper Epidermis
Wax Cuticle
Palisade Mesophyll
Mesophyll
Air Space
Spongy Mesophyll
Stoma
Lower Epidermis
Wax Cuticle
Guard Cell with Chloroplasts


Vascular bundle
Epidermis
Phloem
Cambium
Xylem
Pith
Cortex

Exam Question

1 Leaves are made from layers of cells.

The diagram shows a section through part of a leaf.



(a) (i) Which word in the table describes layer **A**?

Tick (✓) **one** box.

Layer A	Tick (✓)
Tissue	
Organ	
Cell	

(1)

(ii) Which word describes a whole leaf?

Draw a ring around **one** answer.

organ **tissue** **organism**

(1)

(b) (i) Which **two** layers of cells, **A**, **B**, **C** and **D**, can photosynthesise?

Use information from the diagram to help you.

Tick (✓) **two** boxes.

Layer **A** ☐

Layer **B** ☐

Layer **C** ☐

Layer **D** ☐

(2)

(ii) Give **one** reason for your answer.

_____

_____

(1)

(c) List **X** gives the names of two parts of a cell.
List **Y** gives information about parts of a cell.

Draw **one** line between each part of the cell in list **X** and information about it in list **Y**.

List X **Part of a cell**	**List Y** **Information**
Vacuole	Controls the passage of substances into the cell
Nucleus	Contains the cell sap
	Controls the activities of the whole cell

(2)

(Total 7 marks)

2 (a) Put a tick (✓) in the correct boxes in the table below to show which of the parts given are present in the cells and organisms listed.

	CYTOPLASM	NUCLEUS	CELL WALL	GENES
Leaf mesophyll cell				
Sperm				

(2)

(b) (i) What is the main job of a leaf mesophyll cell?

_____

_____

(1)

(ii) Explain **one** way in which the structure of the leaf mesophyll cell helps it to carry out its job.

_____

_____

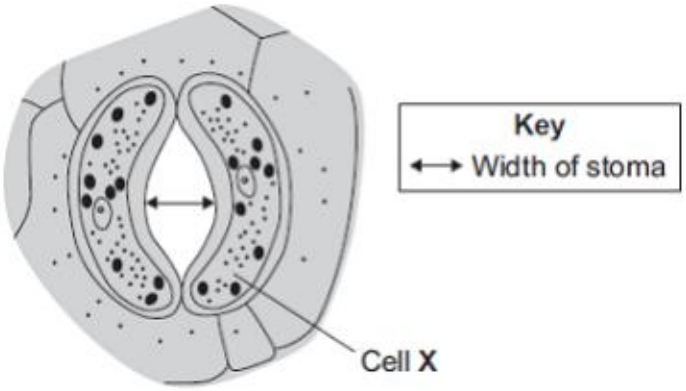
_____

_____

(2)

(Total 5 marks)

3 Plant leaves have many stomata.
The diagram shows a stoma.



(a) Name cell **X** _____

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	Mean width of stomata as a percentage of their maximum width	
		Species A	Species B
Dark	0	95	5
	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
Dark	20	86	6
	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

(4)

(Total 5 marks)

Lesson 13 – Plant Transport

4.2.3.2 Plant organ system

Content	Key opportunities for skills development
Students should be able to explain how the structure of root hair cells, xylem and phloem are adapted to their functions. Students should be able to explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration.	AT 3, 4, 5 Measure the rate of transpiration by the uptake of water. AT 6, 7 Investigate the distribution of stomata and guard cells. MS 2a, 2d, 5c Process data from investigations involving stomata and transpiration rates to find arithmetic means, understand the principles of sampling and calculate surface areas and volumes.
The roots, stem and leaves form a plant organ system for transport of substances around the plant. Students should be able to describe the process of transpiration and translocation, including the structure and function of the stomata. Root hair cells are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport. Xylem tissue transports water and mineral ions from the roots to the stems and leaves. It is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream. The role of stomata and guard cells are to control gas exchange and water loss. Phloem tissue transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage. The movement of food molecules through phloem tissue is called translocation. Phloem is composed of tubes of elongated cells. Cell sap can move from one phloem cell to the next through pores in the end walls. Detailed structure of phloem tissue or the mechanism of transport is not required.	

Root

Roots are plant organs that are usually found below the soil. As a result they are white because they don't contain green chloroplasts for photosynthesis. Roots absorb water by osmosis and minerals by active transport from the soil. They also anchor the plant into the soil. In addition, in some plants, roots can store the glucose made during photosynthesis, usually as starch.

The meristem is found at the very tip of the root. Here new cells are produced to allow the root to grow deeper into the soil. On the outside of roots are root hair cells to absorb water by osmosis. These are specialised epidermal cells. In the middle of the root are the xylem and phloem tissues.

Shoot

Scientists define a shoot as the stem, its leaves, and its buds (not just the very tip of a young plant).

The meristem is found at the very tip of the shoot. Here new cells are produced to allow the shoot to grow towards the light. On the outside of shoots are epidermal cells.

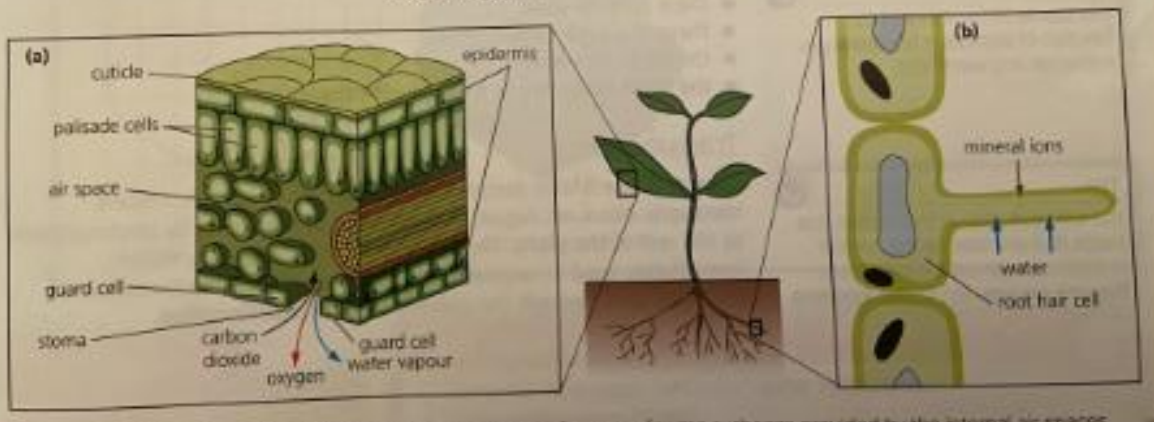
Leaf

The leaf is a plant organ and is the major site of photosynthesis. It also controls the flow of water through the plant. Previously you learnt that water is absorbed by osmosis from the soil into the roots. It is then 'pulled' through the plant by the **transpiration stream** because it is continuously being released from the leaves through stomata, which open and close to regulate this process.

Plant organ systems

Transportation organ system

You have already learnt that xylem and phloem are tissues, and that roots, shoots and leaves are plant organs. These combine to make the plant transportation organ system, which transports all substances around a plant.



▲ Figure 5.6 (a) A cross-section of a leaf showing the large surface area for gas exchange provided by the internal air spaces, and the movement of materials through the stomata. (b) Root hair cells give the roots a large surface area for absorption.

Transpiration and the transpiration stream

Water enters root hair cells in plant roots by osmosis. It then travels by osmosis through the cells of the root and then enters xylem cells. It travels up through the root and stem in long continuous columns of xylem cells. Eventually the xylem branches to form veins that carry the water to the leaves, where it enters the leaf cells.

Much of this water evaporates out of the leaf cells (mainly the spongy mesophyll cells) and enters the leaf air spaces as water vapour. This then diffuses out of the leaf through the air spaces and stomata. This is a continuous process, and the loss of water from a plant through the leaves is called transpiration. The constant evaporation of water from the leaves pulls, or 'sucks', the water up through the rest of the plant in a long, unbroken transpiration stream.

Transpiration has a number of functions, including:

- providing water for leaf cells and other cells (e.g. to keep them **turgid**)
- providing water to cells for the process of **photosynthesis**
- transporting **minerals** to the leaves.

Diffusion of any substance happens faster if the concentration gradient is greater (that is, the difference between the high and low concentrations is bigger). If the air surrounding a leaf is very **humid** (like just before a thunderstorm) then the water vapour gradient will be less steep so the rate of transpiration will be lower. On windy days the air surrounding the leaves is continually replaced. This keeps the concentration gradient steep and the rate of transpiration high. When temperatures are higher the rate of evaporation of water is higher and so transpiration occurs more rapidly. Water is also used up more rapidly during the daylight hours as some of it is used to make glucose by photosynthesis, so transpiration is increased. Also, the stomata are more likely to be open during the day.

In summary, high rates of transpiration are achieved when:

- there is **more wind**
- there is a **high temperature**
- the air is **less humid**
- the **light intensity is high** (during the day).

Translocation

Phloem tissue is also part of the transport organ system. Phloem transports dissolved sugars that are made in the leaves by photosynthesis to the rest of the plant. The transported sugar is usually either immediately used in respiration or stored as starch. The movement of dissolved food through the phloem is called **translocation**.

Exam Questions

1 Substances are transported through plants.

(a) Use the correct answer from the box to complete each sentence.

capillary	**guard cells**	**phloem**
stomata	**transpiration**	**xylem**

(i) Water is transported from the roots to the stem of a plant

in the _____ .

(1)

(ii) Dissolved sugars are transported through the plant

in the _____ .

(1)

(iii) Movement of water through the plant is called the

_____ stream.

(1)

(iv) Water vapour moves out of the plant through pores

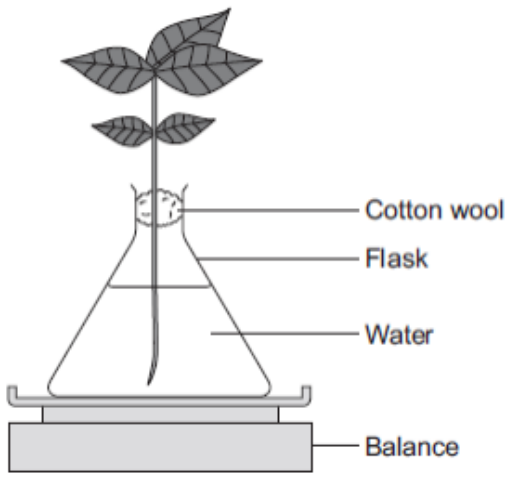
called _____ .

(1)

(b) Students investigated the effect of different conditions on water loss from leaves.

The apparatus is shown in **Figure 1**.

Figure 1



The students set up four flasks, **A**, **B**, **C** and **D**.

The students:

- used the same size plant shoot in each flask
- recorded the mass of the flask and plant shoot at the start of each experiment
- left each flask and plant shoot in different conditions
- recorded the mass of each flask and plant shoot after 2 hours.

Table 1 shows the conditions that flasks **A**, **B**, **C** and **D** were left in for 2 hours.

Table 1

Flask	Temperature in °C	Fan or no fan
A	20	No Fan
B	20	Fan
C	35	No Fan
D	35	Fan

(i) Suggest why the students used cotton wool in each flask.

_____

_____

(1)

(ii) The use of the same size of plant shoot made the investigation a fair test.

Explain why.

_____

_____

_____

_____

_____

(2)

(iii) **Table 2** shows the students' results.

Table 2

Flask	Conditions		Mass at the start in grams	Mass after 2 hours in grams	Mass of water lost in 2 hours in grams
	Temperature in °C	Fan or no fan			
A	20	No Fan	150.0	148.1	1.9
B	20	Fan	152.0	148.5	3.5
C	35	No Fan	149.0	145.9	3.1
D	35	Fan	150.0	145.5	

What mass of water was lost by the plant shoot in flask **D**?

_____

_____

_____ grams

(1)

(iv) Suggest what conclusion can be made about the effect of temperature on water loss from the plant shoot.

_____

_____

_____

(1)

(v) Suggest what conclusion can be made about the effect of the fan on water loss from the plant shoot.

_____

_____

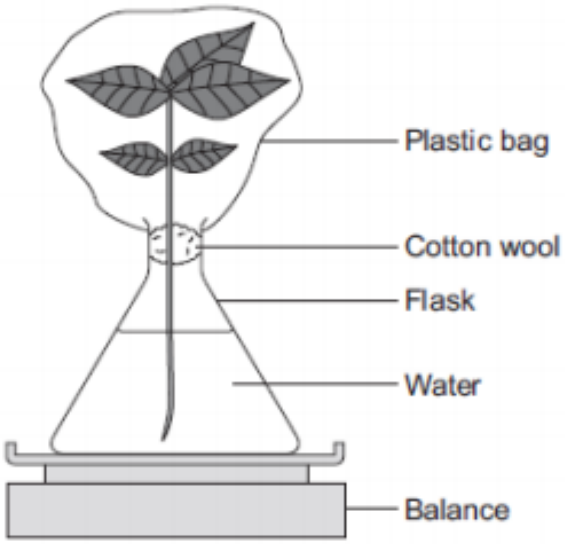
_____

(1)

(c) The students carried out another experiment at 20 °C, with no fan.

The students used the apparatus in **Figure 2**.

Figure 2



In this experiment, the students:

- recorded the mass of the flask and plant shoot before tying the plastic bag around the plant shoot
- removed the bag after 2 hours and recorded the mass again.

(i) What mass of water would be lost from the plant shoot in 2 hours?

Draw a ring around the correct answer.

0.3 g **1.9 g** **3.9 g**

(ii) Give a reason for your answer to part **(c)(i)**.

_____

_____

_____

(1)

(Total 12 marks)

The table gives information about a geranium plant and a cactus plant.

The geranium grows in gardens in the UK. The cactus grows in hot deserts.

Feature	Geranium	Cactus
Thickness of waxy cuticle in micrometres	5	15
Total leaf surface area in cm^2	1800	150
Percentage of water storage tissue in stem	50	85
Number of stomata per mm^2	59	13
Time of day when stomata open	daylight	at night
Horizontal spread of roots in metres	0.2	5

Using only information in the table, explain how the cactus is better adapted for living in hot, dry conditions.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 5 marks)

Lesson 14 – Active Transport

4.2.3.2 Plant organ system

Content	Key opportunities for skills development
Students should be able to explain how the structure of root hair cells, xylem and phloem are adapted to their functions. Root hair cells are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.	AT 3, 4, 5 Measure the rate of

- Active transport involves the movement of a substance against a concentration gradient and requires energy from respiration.
- Mineral ions can be absorbed by active transport into plant root hairs from very dilute solutions in the soil.
- Sugar can be absorbed by active transport from the gut into the blood.

Fill in the blanks:

Particles in a liquid and a ____ are free to move around. They do so in _____ directions. For the particles of a solid to move around freely, it must first be _____ in a liquid.

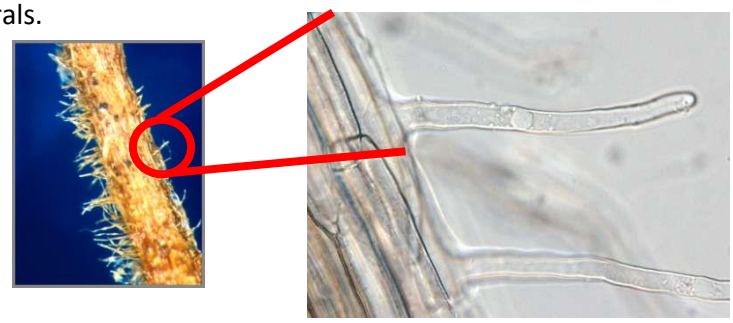
- Diffusion is the process by which particles move from an area where they are in _____ concentration to an area where they are in _____ concentration. An example of diffusion is oxygen diffuses from the _____ into the blood.

- Osmosis is a special type of diffusion. It only applies to _____ molecules. It is the process by which water molecules move from an area where they are in high concentration to an area where they are in low concentration across a _____ _____ membrane.

- An example of a partially permeable membrane is the cell membrane, which controls what can enter and leave the cell. It does this by having tiny pores in it which are only big enough for _____ molecules to fit through.

- Living organisms rely on both these processes to get essential substances into cells and waste substances out of cells.

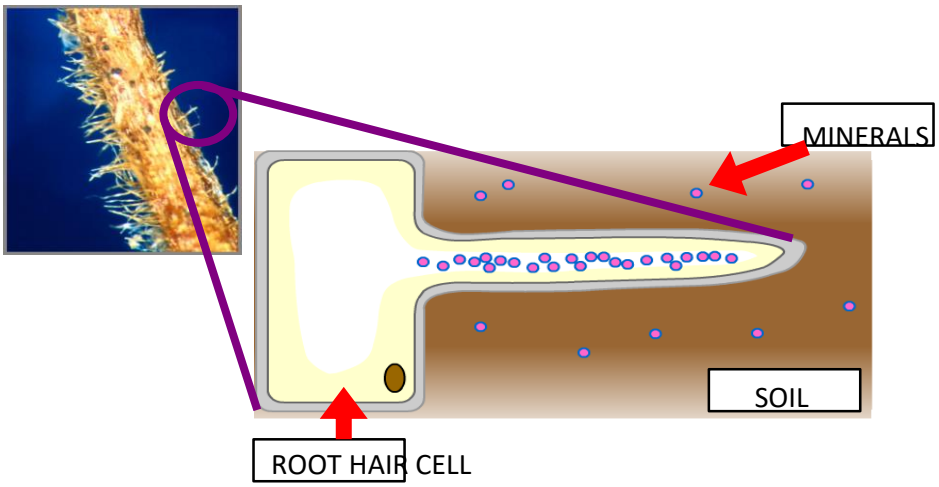
We know that plants have to obtain minerals from the soil in order to function correctly, and water from the soil in order to stay cool, do photosynthesis and maintain turgidity. To do this they must have an efficient mechanism for absorbing water and minerals.



This is achieved by the cells on the surface of roots developing into root hair cells, which have a protrusion on them, which gives them a **large surface area for absorption**.

This allows water to move into the roots by osmosis at a **much faster rate**.

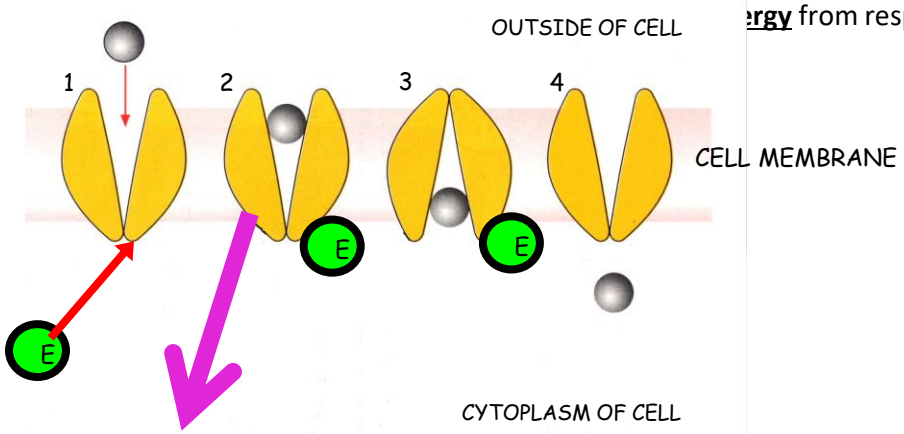
Plants have to overcome a problem with getting minerals from the soil...



The **concentration gradient** is the wrong way round for minerals to enter the root hair cell by diffusion (there is a higher concentration ***inside*** the cell)

In order for the plant to continue to absorb minerals from the soil, it has to use a third type of transport mechanism.
This is called **active transport.**

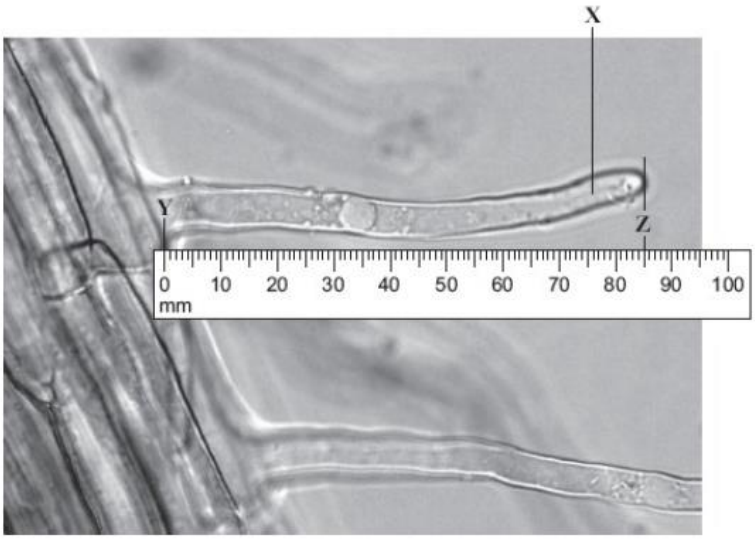
Active transport is the movement of dissolved substances e.g. ions and sugars, from an area of **low** concentration to an area of **high** con **ergy** from respiration to power a series of "pro



This is a protein pump and it requires energy to work

Lesson 14 – Exam Questions

Q1. The photograph shows part of the surface of a plant root. This part of the root is covered with hundreds of structures like the one labelled **X**.



(a) What is the name of structure **X**?

Draw a ring around **one** answer.

root hair **stoma** **villus**

(1)

(b) (i) Use the scale to measure the length **Y–Z** on the photograph.

On the photograph, length **Y–Z** = ... mm.

(1)

(ii) The photograph shows the root magnified 100 times.

Calculate the actual length **Y–Z**.

.....

.....

.....

Actual length **Y–Z** = ...mm.

(2)

(iii) Structure **X** is very small. There are thousands of structures like **X** on a plant root.

How does this help the plant?

.....

.....

.....

.....

(2)

(Total 6 marks)

Q2. The table shows the concentrations of some mineral ions in the cells of a pond plant and in the surrounding pond water.

	Concentration in mmol per dm^3		
	Potassium	**Calcium**	**Sulphate**
Plant cells	49.0	7.0	7.0
Pond water	0.5	0.7	0.4

(i) The plant cells would not have been able to absorb these mineral ions from the pond water by diffusion. Explain why not.

.....

.....

(2)

(ii) Suggest a process which would allow these ions to be absorbed from the pond water by the plant cells.

.....

(1)
(Total 3 marks)

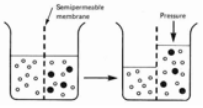
Lesson 15 - Revision

I can…	Tick
Name the levels of organisation from cell to organism	
Describe the functions of all parts of the digestive system	
Name 3 digestive enzymes, state where they are produced and which substrates they act on	
Describe the lock and key hypothesis of enzyme action	
Explain how enzymes can be denatured	
Describe how the heart works and explain why it is sometimes called a double pump	
Describe the process of breathing and explain how the lungs are adapted for gas exchange	
Name 3 types of blood vessels, state if they carry oxygenated or deoxygenated blood and describe adaptations	
Describe the functions of the 4 components of blood	
Explain how coronary heart disease arises and describe how it can be treated	
Explain what cancer is and what the risk factors are	
Give examples of plant tissues and organs and explain how they are adapted to their function	
Explain the process of transpiration	
Know where translocation occurs	
Synoptic knowledge required:	
Label parts of the cell and explain their function	
Describe and explain the processes of diffusion, active transport and osmosis	

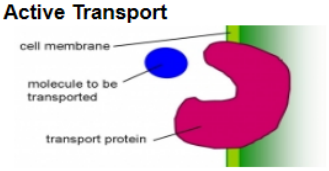
What is diffusion?

Explain Osmosis

Osmosis is the _____of water from a d____ to a m____ concentrated solution through a partially p_____ m_____.



Active Transport



Used to move substances from ___ to ___ concentration (against a concentration g_____) it requires e____ so cells involved often have a lot of m_____ E.g. in the gut nutrients are moved from gut (low conc) to b____ (high conc).

Animal Tissue

Muscular tissue –

Glandular tissue –

Epithelial tissue –

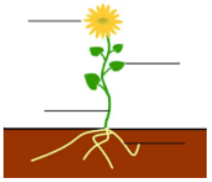
What is transpiration stream?

Transpiration stream is the _____ of water from the _____ up the stem via _____ to the _____ . As water _____ via the stomata.

How does the stomach function as an organ?

- muscular tissue,
- glandular tissue,
- epithelial tissue,

Add labels to the diagram to give the names of the plant organs.



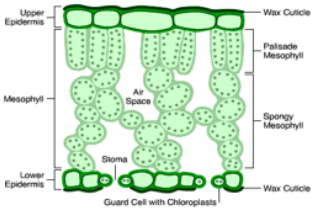
Plant tissues:

Epidermal tissue –

Mesophyll tissue –

Xylem –

Phloem –



Order these starting with the smallest.
Organs, Cells, Organ system, Tissue, Organism

What is an enzyme and what is its function?

Add labels to the following diagram of an enzyme-substrate complex.

What is meant by enzyme specificity and why are enzymes specific?

Give two factors that affect the rate of an enzyme controlled reaction.

What is the name given to the part of the enzyme that enables it to recognize a substrate?

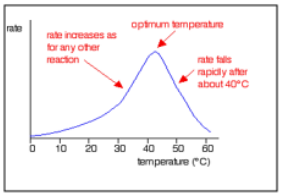
What is the function of digestive enzymes?

What type of cells produce digestive enzymes?

Explain what happens when a enzyme becomes denatured

State where bile is
Produced?
Stored?
Acts?

What are the two functions of bile?



Look at the graph on the left which shows how temperature affects an enzyme-controlled reaction.

a. Describe the effect of temperature on the rate of reaction.

Why does the stomach produce hydrochloric acid?

Complete the table below to show where the following enzymes are made and where they act.

Enzyme	Where it is made	Where it acts
Amylase		
Protease		
Lipase		

b) Explain the shape of the graph.

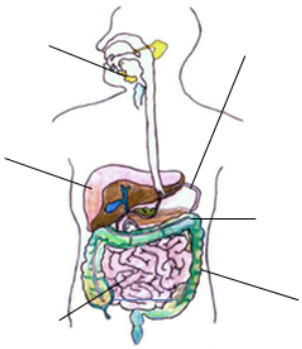
2016 biology Organisation lesson 14

Complete the table below to show the functions of the different digestive enzymes.

Enzyme	Substrate	Product	Use of product
Amylase			
Protease			
Lipase			

Write a word equation for aerobic respiration.

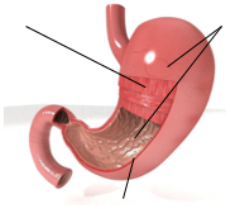
Add labels to the diagram of the digestive system and give the function of each labeled part.



Blood

Plasma-liquid carries blood cells and other substances e.g. glucose and CO_2.
Red blood cells contain _____this binds to oxygen creating oxyhaemoglobin, the oxygen can then be released to cells. This unbinding happens faster in tissues where there is high levels as the haemoglobin naturally becomes less oxygen s_____.
White blood cells make a_____, a_____
Platelets help _____ at a wound

Label the diagram to give the names of the tissues that make up the stomach and give the function of each.



Why is the heart called a double pump?
The left side-
The right side-

Why are there valves in the heart and veins?

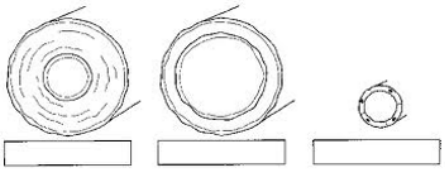
How does blood get moved between atrium and ventricles?

2016 biology Organisation lesson 14

Give a definition of a tissue.

What is an organ?

Name and describe the blood vessels given below.



Give a definition of a tumour.

Describe how tumours spread.

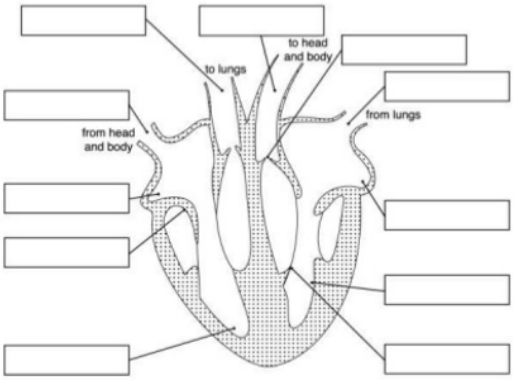
What are the differences between the two types of tumours.

Explain what happens to the heart in coronary heart disease.

What is the importance of elastic fibres in arteries?

What is the importance of muscle fibres in arteries?

Label the heart and the journey of the blood through the heart.



Give two possible risks of operations,

Evaluate the use of stents to treat coronary artery blockages.
_____supressant drugs needed. Doesn't make recipient change diet. Drug coated stents very e_____ but do not r_____ unlike artificial stents.

Evaluate the using of artificial heart valves.
Very expensive. N_____need to be replaced. Will not r____. Immunosupressant drugs not needed.

Evaluate the using of biological heart valves.
Readily available. Need _____every 15 years. Immunosupressant drugs needed.

Evaluate the use of artificial hearts.
L_____ than normal heart / un_____. No need to match t_____ type. Immunosupressant drugs not needed.

2016 biology Organisation lesson 14

Answers:

Lesson 1: Task 1:

Level of organisation	Definition	Example in plants	Example in animals
Cells	The smallest unit of an organism	Palisade cell	Glandular cells
Tissues	A group of cells with a similar structure and function, which all work together to do a particular job.	Leaf epithelium	Stomach lining
Organs	Made from a group of different tissues, which all work together to do a particular job.	Leaves	Stomach
Organ system	Made from a group of different organs, which all work together to do a particular job.	Photosynthetic system	Digestive system
Organism	An individual plant, animal, or single-celled organism.	Daffodil	Human

Task 2:

What does specialised mean?
Adapted to a specific function or environment.

What are the two things that muscle tissue can do?
Contract and conduct electrical impulses

Give an example of a muscle with contracts voluntarily and one that contracts involuntarily.
Cardiac muscle – involuntary Skeletal muscle – voluntarily

Give one example of where glandular tissue is found in the body.
Stomach (other options are anywhere that produces hormones and/or enzymes.)

Why must the glandular tissue be close to capillaries.
So hormones can be delivered to the rest of the body

Why would the human digestive system need glandular tissue.
To produce digestive enzymes

How are epithelial tissues specialised?
Forms the covering or lining of internal and external body surfaces.

Where in the body would you find epithelial tissue?
Any internal or external body surface.

Exam Questions In a living organism, the cells are organised into organs, systems and tissues.

(a) Use words from the box to complete the list of these structures in order of size. The smallest structure is at the top of the list and the largest is at the bottom.

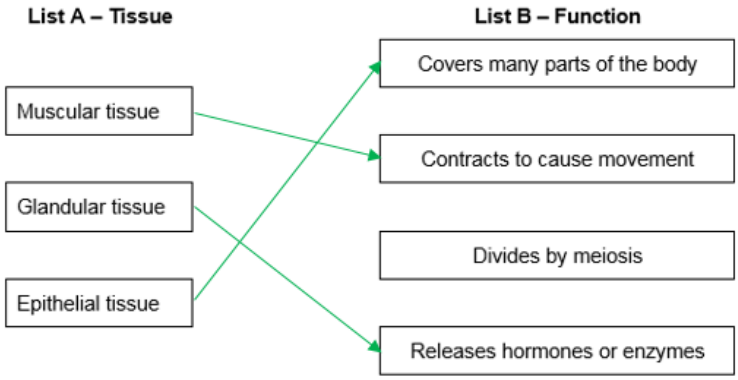
1 **cells** (smallest

2 **Tissues** _____

3 **Organ** _____

4 **System** _____ (largest)

5 **organism**



(b) Draw **one** line from each part of the human body to its correct scientific name.

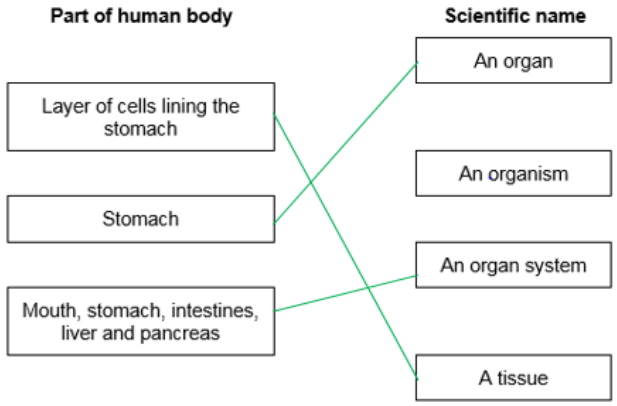
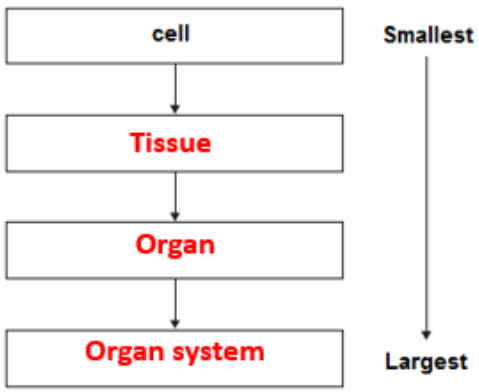


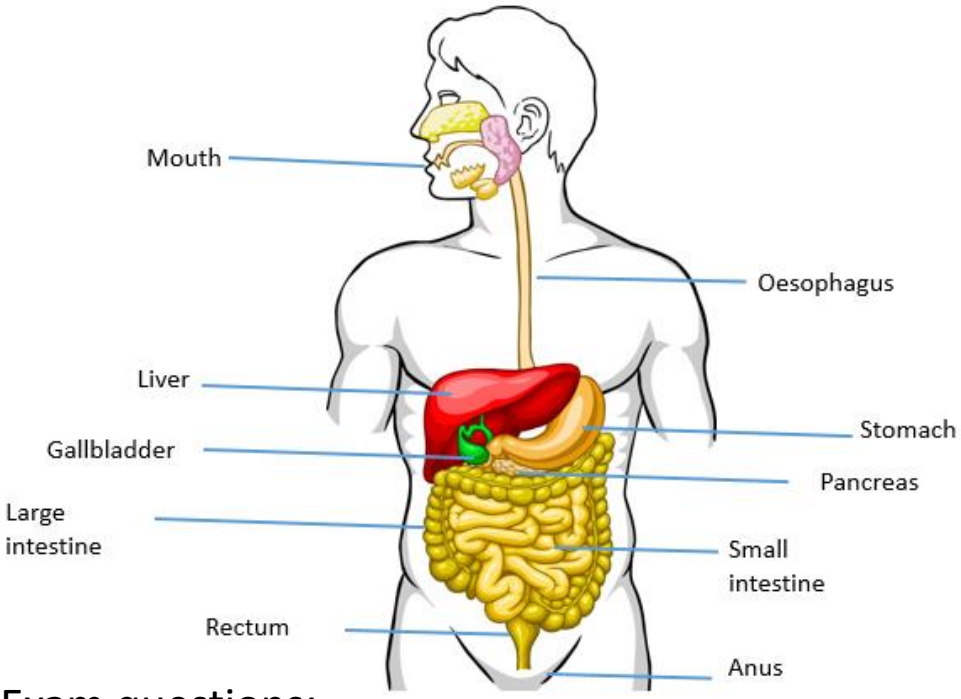
Figure 1

(3)

Q5.



Lesson 2: Label the digestive system.



Exam questions:

1 (a) **A** – saliva(ry) gland 1

B – liver 1

C – duodenum 1

ignore small intestine

D – pancreas

accept phonetic spellings

1 ai) Capillary - 1 mark

(ii) diffusion – 1 mark

bi) Z – 1 mark

ignore any names

ii) Large/ increased surface/ area 1 mark

allow all food absorbed

OR to absorb more food

OR improved diffusion

2 (a)

Structure	Organ	Organ system	Tissue
Stomach	✓		
Cells lining the stomach			✓
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine		✓	

all 3 correct = 2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks

2

(b) (i) diffusion

allow phonetic spelling

1

(ii) glucose

1

(iii) mitochondria

1

[5]

LESSON 3:

Task 1: Write down if the following statements are **true** or **false**:

1. Enzymes are made up of carbohydrate molecules. FALSE
2. Enzymes are biological catalysts. TRUE
3. The specially shaped region of an enzyme molecule is called the active mouth. FALSE
4. Enzymes are non-specific. FALSE
5. Enzymes speed up the reactions. TRUE

Task 2: Fill In the gaps:

Enzymes are BIOLOGICAL catalysts - catalysts are substances that INCREASE the rate of chemical reaction. Enzymes are PROTEINS that are folded into complex 3D shapes. The place where these substrate molecules fit is called the Active site.

Enzymes are special proteins that can break large molecules into small molecules; they act as biological catalysts. Different types of enzymes can break down different nutrients.

enzyme	reaction catalysed
Amylase	starch → sugars
protease	proteins → amino acids
lipase	lipids → Fatty acids + glycerol

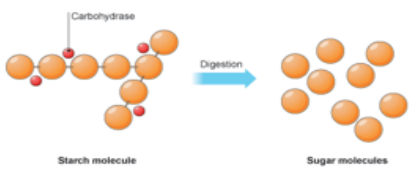
Different parts of the gut produce different enzymes.

enzyme	where produced
amylase	salivary glands, pancreas, small intestine
protease	stomach, pancreas, small intestine
lipase	pancreas, small intestine

Carbohydrates

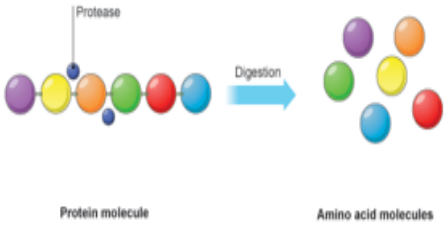
Carbohydrates are digested in the **mouth**, **stomach** and **small intestine**. carbohydrase enzymes break down **starch** into **sugars**.

The saliva in your **mouth** contains amylase, which is another starch digesting enzyme. If you chew a piece of bread for long enough, the **starch** it contains is digested to **sugar**, and it begins to taste sweet.



Proteins

Proteins are digested in the **stomach** and **small intestine**. protease enzymes break down **proteins** into amino acids. Digestion of proteins in the stomach is helped by **stomach acid**, which is strong hydrochloric acid. This also kills harmful micro-organisms that may be in the food.



Fats

Lipase enzymes break down fat into **fatty acids** and **glycerol**. Digestion of fat in the **small intestine** is helped by bile, made in the liver. Bile breaks the fat into small droplets that are easier for the lipase enzymes to work on.

1 (a) in sequence

starch

1

sugar

1

protein

1

amino acids

1

(b) (too) large **or** insoluble

*do **not** accept "breaking up"*
*do **not** accept complex*
accept 'need to make molecules smaller / soluble' – reverse argument

1

cannot be absorbed **or**
cannot enter blood **or**
cannot pass through wall / lining of intestine / gut or villi

"body" not enough
***not** large intestine*

1

(c) mouth

accept positive indication

1

(d) enzymes

allow catalysts
*do **not** accept catalase*

1

2

(a) (i) protease

*accept peptidase **or** named protease*
e.g. pepsin / trypsin
allow 'proteinase'

1

(ii) amino acids

accept peptides / polypeptides / peptones

(b) points plotted accurately 1

$\pm \frac{1}{2}$ *square*

*deduct **1** mark per error*

2

best fit curve **or** ruled point-to-point

if double line within $\frac{1}{2}$ *square*
allow sharp apex
*do **not** allow single straight line*
if no points line defines points
*if (5,0) not plotted only penalise **1** mark*
*bar graph wide bars – **no** marks*

bar graph $\pm \frac{1}{2}$ *square max **2** for points*

1

(c) (i) 2 **or** correct from candidate's graph

$\pm \frac{1}{2}$ *square*

1

(ii) stomach

1

(d) proteins are large / product is small

1

proteins (may be) insoluble / product is soluble

1

cannot be absorbed / cannot enter blood **or** cannot pass through gut lining

accept reverse referring to product

Mark schemes

4 (a) (i) liver

1

(ii) on diagram:

'**X** on liver

must be unambiguous (eg not overlapping gall bladder)
intersection of X in liver

1

(b) stomach

1

small intestine

accept duodenum or ileum
extra wrong answers cancel the mark,
eg small intestine (colon) = no marks

1

(c) amylase not produced by stomach

accept no starch digesting enzymes in the stomach
accept correct enzyme not in stomach
accept only proteases in stomach
*do **not** accept protease does not digest starch*

1

acid / low / wrong pH in stomach **or** enzyme would be denatured in stomach **or** amylase only works in neutral / alkaline conditions

incorrect extra information cancels mark
*do **not** accept amylase does not work in the stomach*

1

5 (a) shape changed / destroyed (above 45 °C)

accept denatured
accept active site changed
*do **not** accept enzyme killed*

1

(shape) doesn't fit (other molecules / stain)

1

(b) (i) any **two** from:

- can wash the clothes at higher temperature
- so wash / enzyme action will be quicker
  *do **not** accept idea of bacteria working faster*
- enzyme not destroyed at high temperature / 80 °C
  accept denaturation or description

Lesson 4& 5 :

Enzymes

Proteins are made of long chains of a__mino__ a__cids__.

One example of proteins are e__nzymes__ that act as c__atalysts__.

The long chains of amino acids fold into highly s__pecialised__ 3-D shapes.

These complex 3-D shapes are what make up **ENZYME** molecules.

Each protein has its own number and sequence of amino acids. This gives each protein molecule a particular shape, allowing it to carry out a particular function).

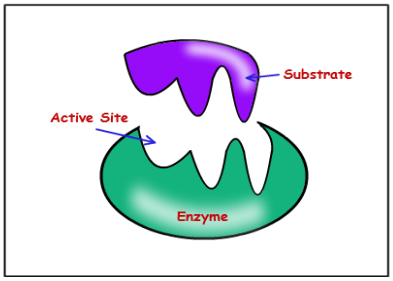
It makes a unique SHAPE called the A__ctive__ S__ite__,

Only molecules with exactly the right shape will bind to the enzyme and react.

Lock and key theory

Enzymes have a specific 3D structure

They exactly match the shape of a molecule of substrate



Enzymes and Temperature

As the temperature increases, the substrate and enzyme obtain more ..energy..

This leads to them having more ..collisions.., leading to an increase in the ..rate.. of the ..reaction.. As the temperature increases further, the rate will reach a ..maximum..

If the temperature increases too much, the weak ..bonds.. that hold the enzyme together, ..break.. This then changes the ..shape.. of the enzyme's ..active.. ..site.. The substrate can no longer fit and the rate of the reaction ..slows.. down and eventually ..stops..

Exam Questions: 1a)

examples of biology points made in the response:

- (use of measuring cylinder to) measure equal volumes of detergent solution
- (use of dropping bottle to) apply same number of drops / amount of stain to each piece of cloth
- include stainless cloth as control
- use of forceps to transfer cloths
- use of test tubes as containers for detergent solution + stained cloth
- use water bath to provide a range of temperatures
- cloths left in detergent solution at each temperature
- for same length of time or measure time taken to remove stain
- repetition
- assessing the stain removal

6

(b) (i) *y* axis: labelled 'Time (taken to remove stain in) minutes' plus suitable scale

data spread greater than half of grid

1

points or bars plotted correctly to within ± 1 mm

*deduct **1** mark for each incorrect plot up to a maximum of 2*

2

one suitable line of best fit drawn on graph

not feathery

not extrapolated to (0,0)

not point to point as on this occasion it is inappropriate

1

(ii) 6 ± 0.1

accept ecf from student graph

1

(c) activity of enzyme still very high / 84% / over 80%

or

only lost 15% / 16% activity

allow above 60 °C marked decrease in activity

allow 85%

any **two** from:

- rate of reaction high at 60 °C / higher than at lower temperatures
  allow in terms of reaction kinetics / collisions
- higher temperatures would increase (energy) costs
  or
  might damage cloth
  ignore enzyme denaturation
- higher temperatures / 60 °C is better (than lower temperatures) to remove other stains / named stains

  or
  better for killing bacteria / infection control
  eg grease

2

Lesson 7:

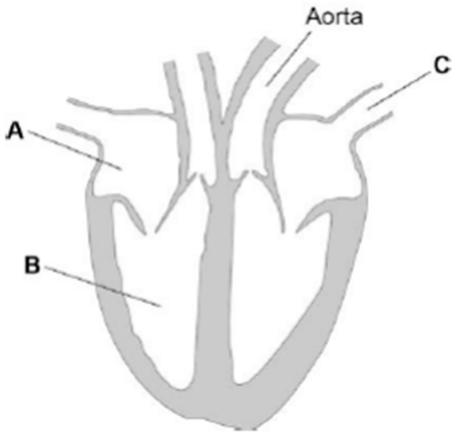
- Your heart beats about 100,000 times a **day** and about 35 million times a **year**.
- In an average **lifetime** the heart pumps about 1 million barrels of blood – 3 super tankers full.
- In 1 day blood travels 19000 **km**
- The pressure the heart exerts as it contracts is about the same pressure that you would need to exert to squeeze a **tennis** ball.

Labels for the heart Diagram:

J= RIGHT VENTRICLE
K= RIGHT ATRIUM
L= VENA CAVA
M= PULMONARY ARTERY
E= AORTA
F= PULMONARY VEIN
G= LEFT ATRIUM
H= LEFT VENTRICLE
X= VALVE

1 **Figure 1** shows a diagram of the human heart.

Figure 1



(a) Name parts **A** and **B**.

A Right atrium

B Right ventricle

(2)

(b) What is the function of blood vessel **C**?

Tick **one** box.

To take blood from the heart around the body	☐
To take blood from the body to the heart	☐
To take blood from the heart to the lungs	☐
To take blood from the lungs to the heart	X

(1)

2 The circulatory system transports substances such as glucose and oxygen around the body.

(a) Name **two** other substances that the circulatory system transports around the body.

1. Carbon dioxide
2. Urea

Protein
Water
Hormones

(2)

(b) (i) plasma

1

platelets

1

(ii) (cardiac) muscle

allow muscular

1

C)

0 marks
No relevant content

Level 1 (1–2 marks)
There is a description of at least one advantage of the cow tissue valve
or
a description of at least one disadvantage of the cow tissue valve.

Level 2 (3–4 marks)
There is a description of at least one advantage of the cow tissue valve
and
at least one disadvantage of the cow tissue valve.

Level 3 (5–6 marks)
There is a description of the advantages and disadvantages of the cow tissue valve
or
a description of several advantages of the cow tissue valve and at least one disadvantage.

Advantages of cow tissue valve:

- abundant supply of cows
- so shorter waiting time

  ignore can take many years to find a suitable human donor
- no need for tissue typing
- quicker operation
- less invasive **or** shorter recovery time
- cheaper operation costs
- less operation / anaesthetic risks.

Disadvantages of cow tissue valve:

- made from cow so possible objections on religious grounds

  ignore ethical arguments
- new procedure so could be unknown risks

  allow possible transfer of disease from cow
- risks of using a stent eg. blood clots, stent breaking or valve tearing
- not proven as a long term treatment
- may be rejected

  ignore information copied directly from the table without value added.

6

Lesson 7: Starter:

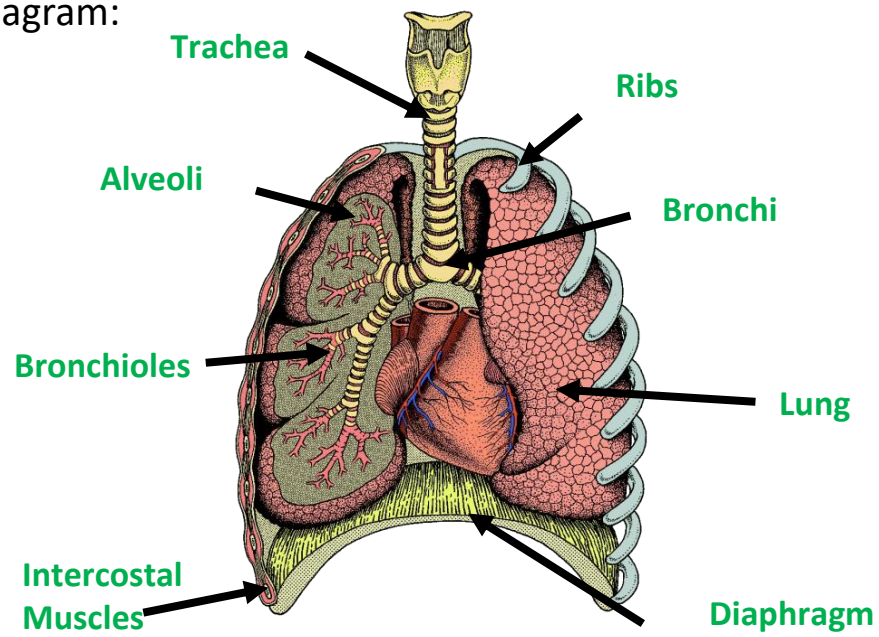
Why do we need to respire?

To provide energy for cell activity and functionality.

Where does respiration occur?

Respiration occurs in the mitochondria (to produce ATP).

Label the lungs diagram:



M1. (a) large surface / large area

1

thin / short distance (from air to blood) / one cell thick / two cells thick

1

good blood supply / many capillaries / capillary network / many blood vessels

ignore moist surface

1

(b) (i) diffusion

ignore gaseous exchange

1

(ii) brings (more) oxygen / air into the lungs / alveoli

1

keeps O_2 level high in alveoli

or

maintains concentration difference (between alveoli and blood) / keeps O_2 concentration in alveoli > O_2 concentration in blood gains **2** marks

1

[6]

M2.(a) (i) diaphragm

accept phonetic spelling

1

(ii) (because) the volume (inside the jar) increases

*maximum **two** marks if no reference to correct part of model*

1

(causing) the pressure to decrease

(and) air enters the balloon

allow oxygen

1

True or False:

1- Gas exchange occurs in tiny air sacs called alveoli. **T**

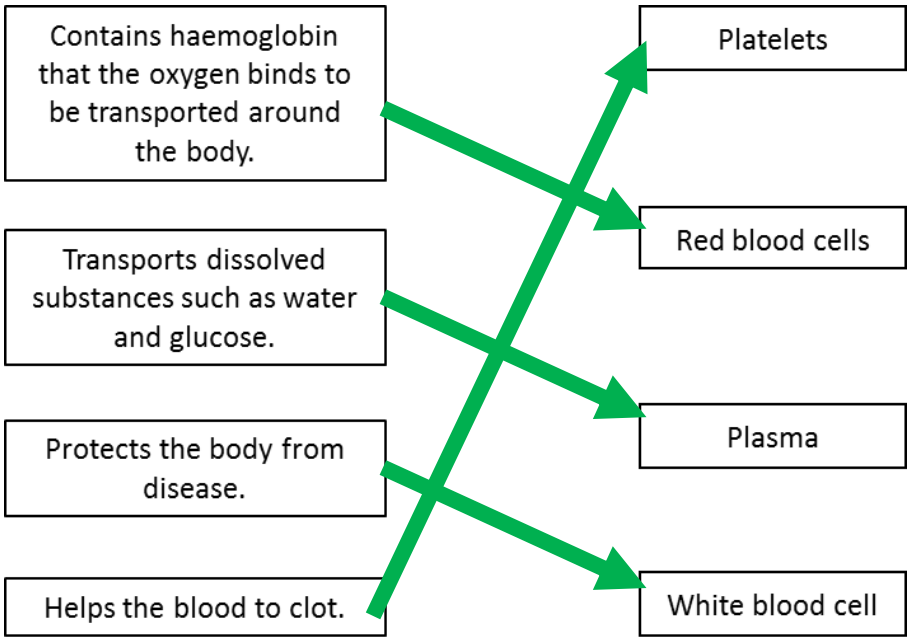
2- Oxygen passes from the blood into the lungs and carbon dioxide passes from the lungs into the blood. **F**

3- The alveoli are specially adapted to allow gas exchange to occur quickly. **T**

4- Gases move by the process of osmosis. **F**

5- Diffusion occurs when gases move from a high concentration to a low concentration. **T**

Lesson 8: Blood



Red blood cells have adaptations that make them suitable for this:

1. **they contain haemoglobin - a red protein that combines with oxygen**
2. **they have no nucleus so they can contain more haemoglobin**
3. **they are small and flexible so that the can fit through narrow blood vessels**
4. **they have a biconcave shape (flattened disc shape) to maximise their surface area for oxygen absorption**

(a) **A** white blood cell/leucocytes / phagocytes / lymphocytes

SEPARATE MARKING POINTS

1

make/contain antibodies/antitoxins
or
destroy/engulf/kill bacteria

*do **not** accept fight infection*
*do **not** accept fight disease*

1

B platelets

1

help clot the blood

*do **not** accept stick together*
*do **not** accept from scabs*

1

C plasma

1

carries/transports all the cells/digested food/waste products/hormones/carbon dioxide/platelets/dissolved minerals/antibodies/antitoxins/water

allows blood to flow

1

Mark Scheme

(a) (i) haemoglobin / oxyhaemoglobin

must be phonetic

1

(ii) carries oxygen **or** forms oxyhaemoglobin

Ignore references to CO_2 / iron
cancel if extras like food / glucose

1

from lungs to tissues

1

(b) no nucleus **or** biconcave disc (described)

ignore references to size
ignore vague references to being 'round' / 'donut' shaped etc.

1

LESSON 9:

1- What is CHD?

The coronary arteries supply blood to the heart muscle. These may become blocked by a build-up of **fatty plaques** containing **cholesterol**, resulting in **coronary heart disease**.

2- What does CHD cause?

If a coronary artery is blocked, the blood supply to part of the heart muscle is cut off. That part of the heart cannot continue to contract, causing a **heart attack**.

3- What symptoms might you experience with CHD?

Difficulty breathing, pain from the heart,

Challenge – *Name some contributing factors that may lead to a person developing CHD.*

These include:

- **poor diet – eating more saturated fat tends to increase cholesterol levels**
- **stress and smoking – increases blood pressure**
- **Lifestyle factors – lack of exercise**

LESSON 9:

Method for treating CHD	How does it work?	Advantages	Disadvantages
Stents	Stents are metal grids which are placed inside the coronary artery and are used to keep it open. This allows the blood to keep flowing to the heart muscle.	using stents are that they provide a quick alternative to other methods if the disease is not too serious.	layer of fat that causes CHD may build up over the stent in the future.
Statins	Drug that people with high cholesterol levels take. They help to reduce the amount of cholesterol in the blood and slow down the amount that builds up in our blood vessels.	Provide a quick alternative to other methods if the disease is not too serious.	Side effects such as liver and kidney problems. Scientists also don't know the long term affect of taking them for a long time.
Heart Transplant	where a healthy donor heart is transplanted into the patient.	heart transplant is that cardiovascular disease is treated completely and can restore health.	procedure is complicated. The body could reject the donor heart and cause it to not work correctly. Infections can also occur.
Nitrates	cause the arteries to dilate	Relieves heart pain, lowers blood pressure.	side effects can include headaches and dizziness. Need to medicine for rest of your life.
Heart valve Replacement	Replacement heart valves to improve circulation of blood	Restore blood flow through the heart. Less risk of complications in surgery than heart transplant.	Biological valves may wear out. Blood clots may stick to mechanical valves - anti-blood clotting drugs need to be taken which

M1.(a) A aorta

ignore left and right

1

B ventricle

1

C atrium

allow atria

1

D vena cava

1

(b) (i) (coronary) artery

allow arteriole

1

(ii) stent / description

accept (coronary) by-pass operation
allow statins

(iii) (stent) keeps artery open

must relate to (b)(ii)

1

1

or

ignore reference to capillary / vein

(by-pass) new blood vessel / vein connecting around narrowed region;

or

(statins / low cholesterol diet) remove some of the cholesterol blockage

or

(balloon) widens / opens the blood vessel

1

which allows (more) blood through or allows blood to go around the blockage

(c) (i) F artery

accept arteriole / branch of pulmonary artery

1

G capillary

1

H vein

H accept venule / branch of pulmonary vein;

1

(ii) F (Pulmonary artery) has less oxygen / more carbon dioxide / more glucose / sugar

accept F (Pulmonary artery) is deoxygenated

accept converse for H (Pulmonary vein)

'It' refers to F

1

[12]

1- Stents are metal grids which are placed inside the veins to keep them open.

False

2- The disadvantage to stents are that a layer of fat can build up over the stent.

True

3- Statins are drugs that are used to treat high cholesterol levels.

True

4- Statins have no side effects are 100% safe.

False

5- Heart valves cannot be replaced once they have become faulty.

False

Lesson 10:

Starter Quiz:

Answers for nutrition section:

If you answered **mostly C's**, well done! - you have a balanced diet full of nutrients.

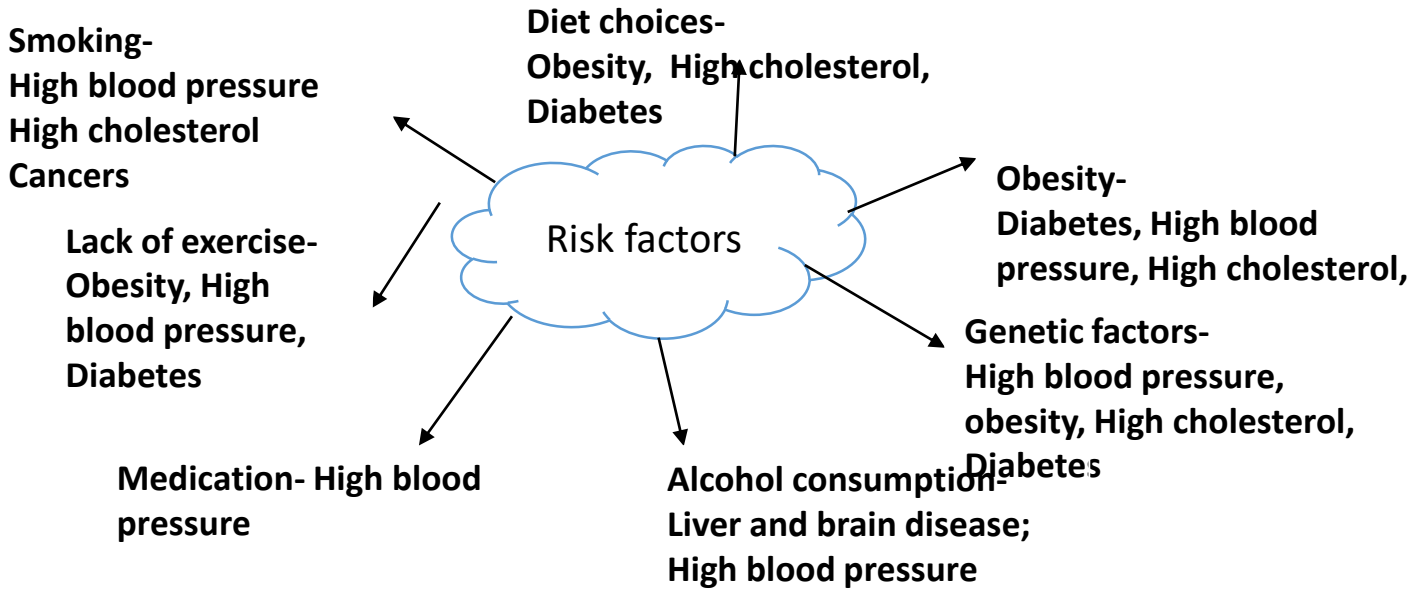
But, if you answered **mostly A's and B's -** you need to eat more healthy foods.

Answers for physical activity section:

If you answered **mostly C's**, excellent! - you are currently leading an active life!

Mostly A's and B's - you need to be physically active!

1. A well-balanced diet, regular exercise, reducing stress and seeking medical help for mental and physical difficulties
2. You have the correct amount of the key food groups
3. At least one hour of physical activity every day
4. Risk factors
5. Mental ill health
6. The feeling of being under too much mental or emotional pressure
7. A feeling of unease, which might be worry or fear
8. Some people feel sad or hopeless, others lose interest in things they used to love



Mark Scheme

(a) any **two** from:

- arthritis
  allow damaged joints
- diabetes
  accept high blood sugar
- high blood pressure
- strokes
  allow blocked blood vessels / thrombosis
- allow breathing difficulties
  ignore cancer
  ignore high cholesterol

2

(b) (i) any **two** from:
to gain marks there must be a comparison
ignore comparison at single age

- lower number of women deaths up to age of 75-80
- higher number of women deaths after 80
  *ignore women die older **or** men die younger*
- men's peak higher
- men's peak at an earlier age
- men's death start earlier than women
- more men than women die of heart disease

2

(ii) any **two** from:

- men smoke more (cigarettes)
  ignore alcohol
- more men smoke
- men under more stress
- men less active
- more men overweight / eat more / less diet conscious **or** different fat distribution
  ignore reference to body size
- genetic factors
- men might have lower metabolic rate
  ignore references to hormones
- men less likely to visit doctor even though they have symptoms

2

Mark scheme

(a) any **two** from:

- diet
  ignore exercise
  accept any reasonable reference to diet
  *do **not** accept salt / blood pressure*
  ignore age / gender / HDL / LDL
- heredity / genes / genetic makeup
- reference to cholesterol production by liver

2

(b) (i) Blood cholesterol concentration is only one of several factors affecting death from all causes

1

(ii) 170 – 210
accept 210 - 170

1

[4]

Lesson 11:

Benign

Abnormal growths of cells which are contained in one area, usually within a membrane. They do not invade other parts of the body.

Malignant

Abnormal growths of cells which can invade neighboring tissues and spread to different parts of the body where they form secondary tumours.

List the risk factors:

- Smoking, Alcohol, Genetic disorders, Ionising radiation, Environmental pollutants, Obesity, Age

[4]

1 (a) (i) (as a result of) uncontrolled / abnormal growth / division of cells

ignore mutation

allow cells dividing with no contact inhibition

1

(ii) benign tumours do not invade / spread to other tissues / do not form secondary tumours

accept converse for malignant

accept benign tumours do not metastasise

1

(b) via the blood / circulatory system

accept via lymphatic system

1

(c) (i) incidence is increasing

1

more rapidly (over the years)

ignore figures

1

difference between rich and poor areas is getting less

or

the incidence is rising fastest in people from poor areas

accept converse for people from rich areas

1

(ii) risk factor is UV from sunlight

ignore ionising radiation

1

more UK citizens going abroad or taking holidays in the Sun

or

poorer people can afford holidays in the Sun

or

more poorer people are taking holidays in the Sun

1

[8]

Mark schemes

2

(a) cells can break off

allow cells invade other tissues

1

travel in blood

accept travel in lymph (fluid)

1

(b) $\frac{(89 - 48)}{48} \times 100 = 85.416\dot{6}$

1

85.4 (%)

*allow 85.4 (%) with no working shown for **2** marks)*

1

(c) any **two** from:

- similar survival rates for diagnosis in 1961
- survival rate (for diagnosis in 2011) is 1.5 times greater for prostate cancer compared to bowel cancer
- (survival rates) have improved for both cancers
- (survival rate) for prostate cancer has improved more

*accept survival rate for bowel cancer has increased 2.4 times **but** for prostate cancer 3.4 / 3.36 times*

2

plus **two** from:

- earlier diagnosis
- improved screening programmes
- improved drugs
- difference in level of aggression of cancers
- difference in ease of removing tumours

reason must be correctly linked to comparison

2

[8]

Lesson 12:

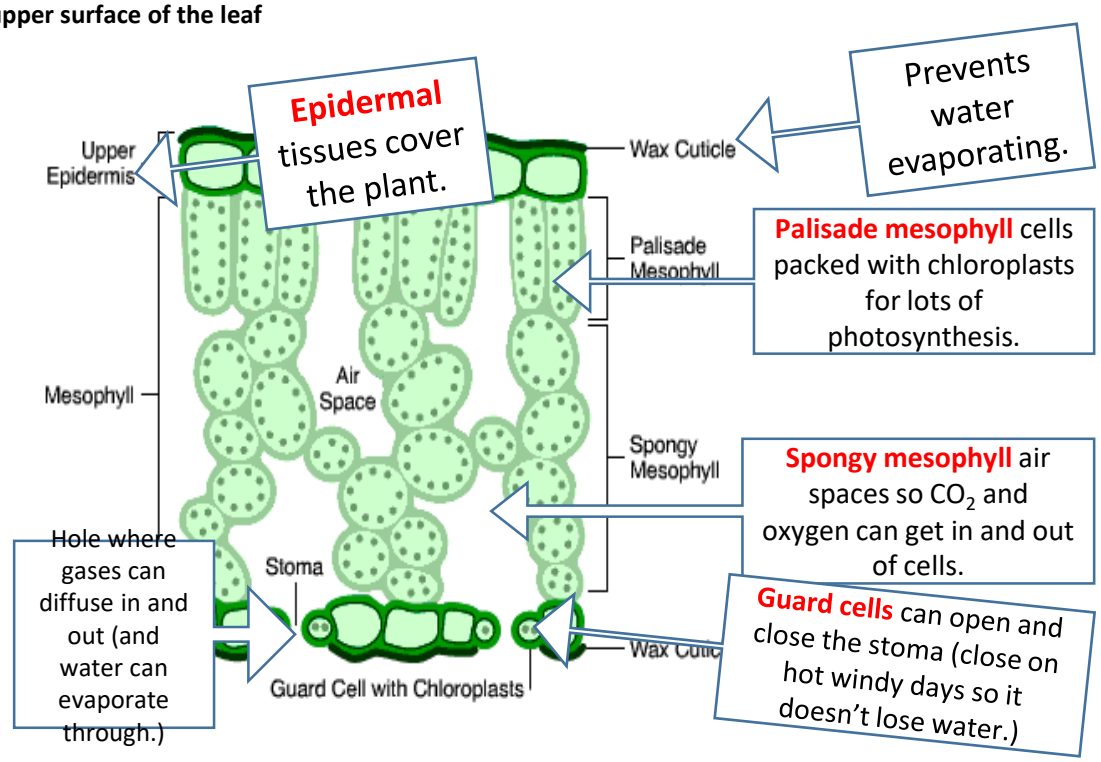
Plant Organs	Function	Specialisation
Flower	Reproduction	Often brightly coloured to attract insects. Contains pollen, stigma and stamen for reproduction
Stem	Support and contains the plants transport systems	Contains 2 tube like structures which carry water and food through the plant
Root	Absorb water and mineral ions from the soil. They also anchor the plant into the soil.	Large surface area, root hairs and large root network
Leaf	Photosynthesis and gas exchange	Contain chlorophyll which absorb sunlight for photosynthesis. Also have pores where exchange of gases for photosynthesis can occur.

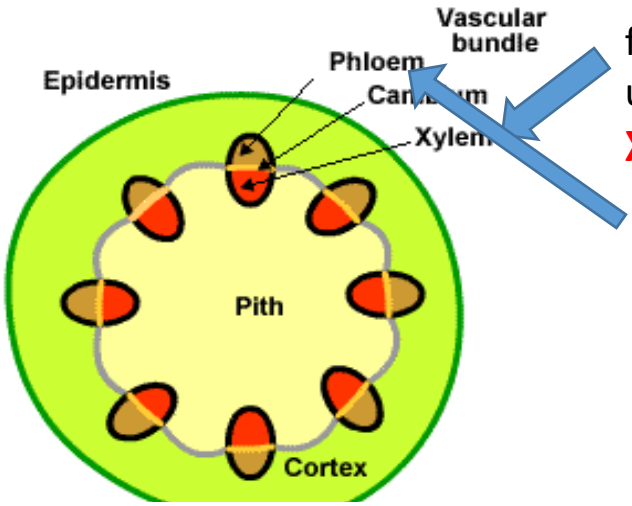
Upper epidermis: protects the surface of the leaf and is transparent. Allows light to pass through.

Spongy mesophyll tissue is packed loosely for efficient gas exchange. The spongy mesophyll cells are covered by a thin layer of water. Gases dissolve in this water as they move into and out of the cells.

The **palisade mesophyll** layer of the leaf is adapted to absorb light efficiently. The cells:

- **are packed with many chloroplasts**
- **are column-shaped and arranged closely together**
- **towards the upper surface of the leaf**





Water travels from **roots to leaves** up the stem in the **XYLEM**.

Sugar travels from **leaves to shoots** and **storage organs** down the stem in the **PHLOEM**.

Mark schemes

1 (a) (i) tissue

extra box ticked cancels the mark 1

(ii) organ

extra ring drawn cancels the mark 1

(b) (i) Layer B

*each extra box ticked cancels **1** mark* 1

Layer C 1

(ii) (contain) chloroplasts / chlorophyll

other parts disqualify 1

(c)

Vacuole	Contains the cell sap
Nucleus	Controls the activities of the whole cell

Controls the passage of substances into the cell

*two correct = **2** marks*

*one correct = **1** mark*

extra line from a part of a cell cancels the mark 2

Lesson 13:

[7]

2 (a) mesophyll / / / / (all correct) sperm / / x / (all correct)
for 1 mark each

(b) (i) absorbs light/to produce food/photosynthesis
(allow references to gaseous exchange)
for 1 mark

1

(ii) has chlorophyll/chloroplasts to absorb light/produce food
for 1 mark each
(if linked to gas exchange allow – moist surface/ dissolve gases)

2

[5]

Mark schemes

3 (a) guard cell
ignore stoma / stomata

1

(b) Species A :
allow converse points for species B

stomata open in dark / at night **or** close in light / in day

1

stomata closed during warm(est) period **or** open when cool(er)

1

heat (energy) /warmth increases evaporation / transpiration
must give explicit link between heat and transpiration

1

reduces water loss / evaporation / transpiration
ignore photosynthesis

1

[5]

Lesson 13:

(a) (i) xylem

1

(ii) phloem

1

(iii) transpiration

1

(iv) stomata

1

(b) (i) any **one** from:

- reduce / prevent evaporation of water from flask
- holds plant shoot in place
- prevent damage to the plant

1

(ii) same surface area **or** number of leaves

(because if they used larger / smaller size shoots) there would be a larger / smaller surface area ***or*** *a larger/ smaller number of leaves*

allow same number of stomata

1

from which (the same amount of) water evaporates

(and therefore) more / less water would escape

allow from which water escapes

1

(iii) 4.5

look for answer written in table

1

(iv) increasing temperature / heat increases (rate of) water loss / evaporation

1

(v) having moving air / a fan increases (rate of) water loss / evaporation

1

(c) (i) 0.3 g

1

(ii) plastic bag reduces air flow across leaves
or
air is humid around the leaves

allow plastic bag stops water (vapour) leaving
allow air (in plastic bag) becomes saturated (with water)

1

Quality of written communication

for ideas given in a sensible order;
comparison made for geranium and cactus for each feature
(ie not just list for geranium followed by list for cactus)
+ linking of feature & explanation

1

any **four** features + explanations from:

cactus has:

accept converse points for geranium plant

Feature	**Explanation**
thicker cuticle	waterproof / keeps water in
smaller surface area	less water loss / less heat absorbed
fewer stomata	less water loss
stomata open at night / closed in day	(closed when warmest) – so less water loss
more widespread roots	quickly absorbs water (after rain) / access to bigger area for absorbing water / absorb more water
more water storage tissue	little water available in environment / can survive drought / avoids dehydration

Lesson 14:

- Particles in a liquid and a **gas** are free to move around. They do so in **random** directions. For the particles of a solid to move around freely, it must first be **dissolved** in a liquid.

- Diffusion is the process by which particles move from an area where they are in **high** concentration to an area where they are in **low** concentration. An example of diffusion is oxygen diffuses from the **alveoli** into the blood.

- Osmosis is a special type of diffusion. It only applies to **water** molecules. It is the process by which water molecules move from an area where they are in high concentration to an area where they are in low concentration across a **partially permeable** membrane.

- An example of a partially permeable membrane is the cell membrane, which controls what can enter and leave the cell. It does this by having tiny pores in it which are only big enough for **small** molecules to fit through.

- Living organisms rely on both these processes to get essential substances into cells and

(a) What is the name of structure **X**?

Draw a ring around **one** answer.

root hair **stoma** **villus**

(1)

(b) (i) Use the scale to measure the length **Y**–**Z** on the photograph.

On the photograph, length **Y**–**Z** = ... 85 ..... mm.

(1)

(ii) The photograph shows the root magnified 100 times.

Calculate the actual length **Y**–**Z**.

..... 85 ÷ 100 .....

.....

..... 0.85 .....

Actual length **Y**–**Z** = ...mm.

(2)

(iii) Structure **X** is very small. There are thousands of structures like **X** on a plant root.

How does this help the plant?

.....

It gives the roots a larger surface

So they can absorb more water/ions

.....

(2)

(Total 6 marks)

Q2. The table shows the concentrations of some mineral ions in the cells of a pond plant and in the surrounding pond water.

	Concentration in mmol per dm^3		
	Potassium	**Calcium**	**Sulphate**
Plant cells	49.0	7.0	7.0
Pond water	0.5	0.7	0.4

(i) The plant cells would not have been able to absorb these mineral ions from the pond water by diffusion. Explain why not.

In diffusion substances move from high to low concentration

Here the conc in the cells is greater than the conc in the water

(2)

(ii) Suggest a process which would allow these ions to be absorbed from the pond water by the plant cells.

Active transport

(1)

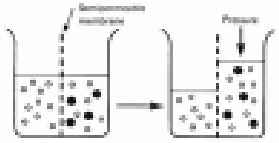
(Total 3 marks)

What is diffusion?

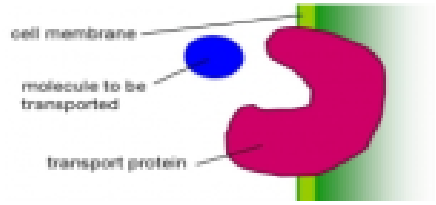
The net movement of particles of a liquid or solute from an area of high concentration to an area of lower concentration

Explain Osmosis

Osmosis is the diffusion of water from a dilute to a more concentrated solution through a partially permeable membrane.



Active Transport



Used to move substances from low to high concentration (against a concentration gradient) it requires energy so cells involved often have a lot of mitochondria E.g. in the gut nutrients are moved from gut (low conc) to blood(high conc).

Animal Tissue

Muscular tissue – allows movement by contraction

Glandular tissue – secrete chemical / hormones/ enzymes

Epithelial tissue – lining to cover parts of the body

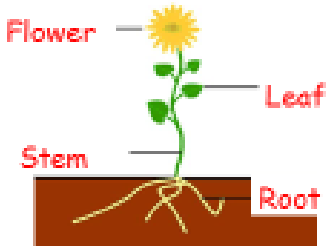
What is transpiration stream?

Transpiration stream is the movement of water from the roots up the stem via xylem to the leaves. As water evaporates via the stomata.

How does the stomach function as an organ?

- muscular tissue, to churn the contents
- glandular tissue, to produce digestive juices
- epithelial tissue, to cover the outside and the inside of the stomach.

Add labels to the diagram to give the names of the plant organs.



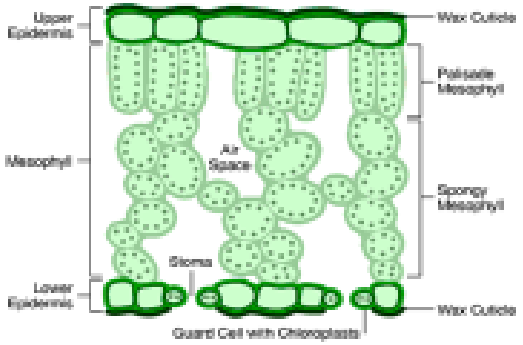
Plant tissues:

Epidermal tissue - which cover the plant

Mesophyll tissue - which carries out photosynthesis

Xylem – transport water up the stem

Phloem – transports glucose all over plant



Order these starting with the smallest.
Organs, Cells, Organ system, Tissue

Cells, Tissue, Organ, Organ system, Organism

What is an enzyme and what is its function?

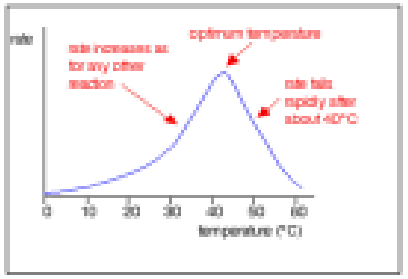
Biological catalyst - speeds up the rate of a reaction

Give two factors that affect the rate of an enzyme controlled reaction.

- Tempearture
- pH

Explain what happens when a enzyme becomes denatured

Shape of the active site changes so the enzyme no longer works,



Add labels to the following diagram of an enzyme-substrate complex.

What is the name given to the part of the enzyme that enables it to recognize a substrate?

Active site

Look at the graph on the left which shows how temperature affects an enzyme-controlled reaction.

a. Describe the effect of temperature on the rate of reaction

- Rate increases up to 40^0C
- Rate is at a maximum at 40^0C
- Above 40^0C rate rapidly falls

b) Explain the shape of the graph.

- Between 0 and 40^0C increasing temperature increases the kinetic energy of molecules so the enzyme and substrate collide more often and with more force
- Above 40^0C the enzyme is denatured so can no longer catalyse the reaction

What is meant by enzyme specificity and why are enzymes specific?

Each enzyme only catalyses one type of reaction.

Each enzyme has a different shape active site

What is the function of digestive enzymes?

To break large insoluble food molecules into small soluble molecules that can be absorbed

What type of cells produce digestive enzymes?

Specialised cells in glands and the lining of the gut

State where bile is

Produced? Liver

Stored? Gall bladder

Acts? Small intestine

What are the two functions of bile?

- Neutralises the stomach acid to produce alkaline conditions so that enzymes in the small intestine are not denatured
- Emulsifies (breaks up) fats so they have a larger surface area on which enzymes can work, meaning they are digested more rapidly

Why does the stomach produce hydrochloric acid?

Stomach enzymes work best in acidic conditions.

Complete the table below to show where the following enzymes are made and where they act.

Enzyme	Where it is made	Where it acts
Amylase	Salivary glands, pancreas, small intestine	Mouth, small intestine
Protease	Stomach, pancreas, small intestine	Stomach, small intestine
Lipase	Pancreas, small intestine	Small intestine

Complete the table below to show the functions of the different digestive enzymes.

Enzyme	Substrate	Product	Use of product
Amylase	Carbohydrate (starch)	Glucose	Substrate for respiration
Protease	Protein	Amino acids	Used to synthesise other proteins
Lipase	Lipids (fats and oils)	Fatty acids and glycerol	Cell membranes, making hormones, insulation, energy store

Blood

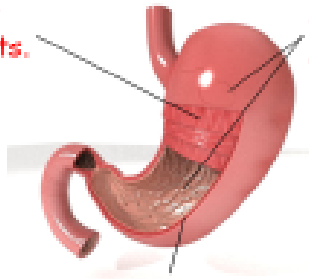
Plasma-liquid carries blood cells and other substances e.g. glucose and CO_2.

Red blood cells contain haemoglobin this binds to oxygen creating oxyhaemoglobin, the oxygen can then be released to cells. This unbinding happens faster in tissues where there is high levels as the haemoglobin naturally becomes less oxygen saturated.

White blood cells make antibodies, anti-toxins

Platelets help clotting at a wound

Label the diagram to give the names of the tissues that make up the stomach and give the function of each.



Muscle tissue: churns contents.

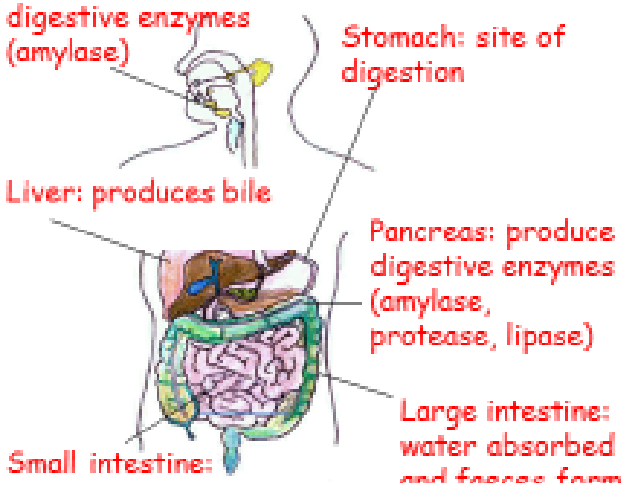
Epithelial tissue: covers inside and outside of stomach

Glandular tissue: produces digestive juices.

Write a word equation for aerobic respiration.

Glucose + Oxygen → Water + Carbon dioxide (+ Energy)

Add labels to the diagram of the digestive system and give the function of each labeled part.



Salivary glands: produce digestive enzymes (amylase)

Stomach: site of digestion

Liver: produces bile

Pancreas: produce digestive enzymes (amylase, protease, lipase)

Large intestine: water absorbed and faeces form

Small intestine: digestion and absorption of soluble products

Why is the heart called a double pump?

The left side- pumps blood to body

The right side- pumps blood to lungs

Why are there valves in the heart and veins?

To prevent the backflow of blood

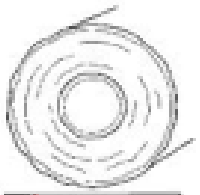
How does blood get moved between atrium and ventricles?

They contract squeezing the blood through a valve.

Give a definition of a tissue.
A group of cells with similar structure and function that work together to perform a particular job

What is an organ?
A part of an animal or plan made up of several tissues working together to do a specific job.

Name and describe the blood vessels given below.



Artery
Toward heart
vein
No valves

Vein
Away from heart
Has valves

Capillary
Join artery to
No valves

Give a definition of a tumour.
(as a result of) uncontrolled / abnormal growth / division of cells

Describe how tumours spread.
via the blood / circulatory system

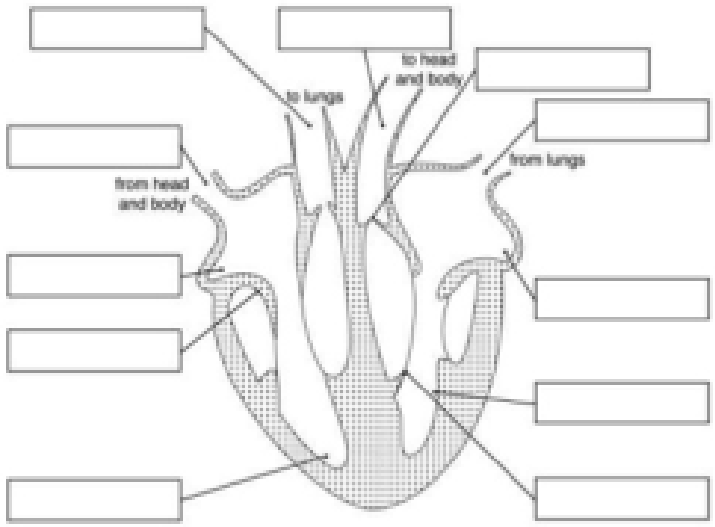
What are the differences between the two types of tumours.
benign tumours do not invade / spread to other tissues / do not form secondary tumours

Explain what happens to the heart in coronary heart disease.
fatty deposits / material in (coronary) arteries
narrows / blocks / reduces flow
decreases oxygen supply (to heart muscle)

What is the importance of elastic fibres in arteries?
Stretch to let the blood pass through

What is the importance of muscle fibres in arteries?
Withstand the high pressure of the blood flow

Label the heart and the journey of the blood through the heart.



Give two possible risks of operations.

- bleeding
- allow blood clots
- infection
- damaging blood vessels
- damaging the heart
- risk from anaesthetic

Evaluate the use of stents to treat coronary artery blockages.
Immunosupressant drugs needed. Doesn't make recipient change diet. Drug coated stents very expensive but do not reclose unlike artificial stents.

Evaluate the using of artificial heart valves.
Very expensive. Never need to be replaced. Will not rust. Immunosupressant drugs not needed.

Evaluate the using of biological heart valves.
Readily available. Need replacing every 15 years. Immunosupressant drugs needed.

Evaluate the use of artificial hearts.
Larger than normal heart / uncomfortable. No need to match tissue type. Immunosupressant drugs not needed.