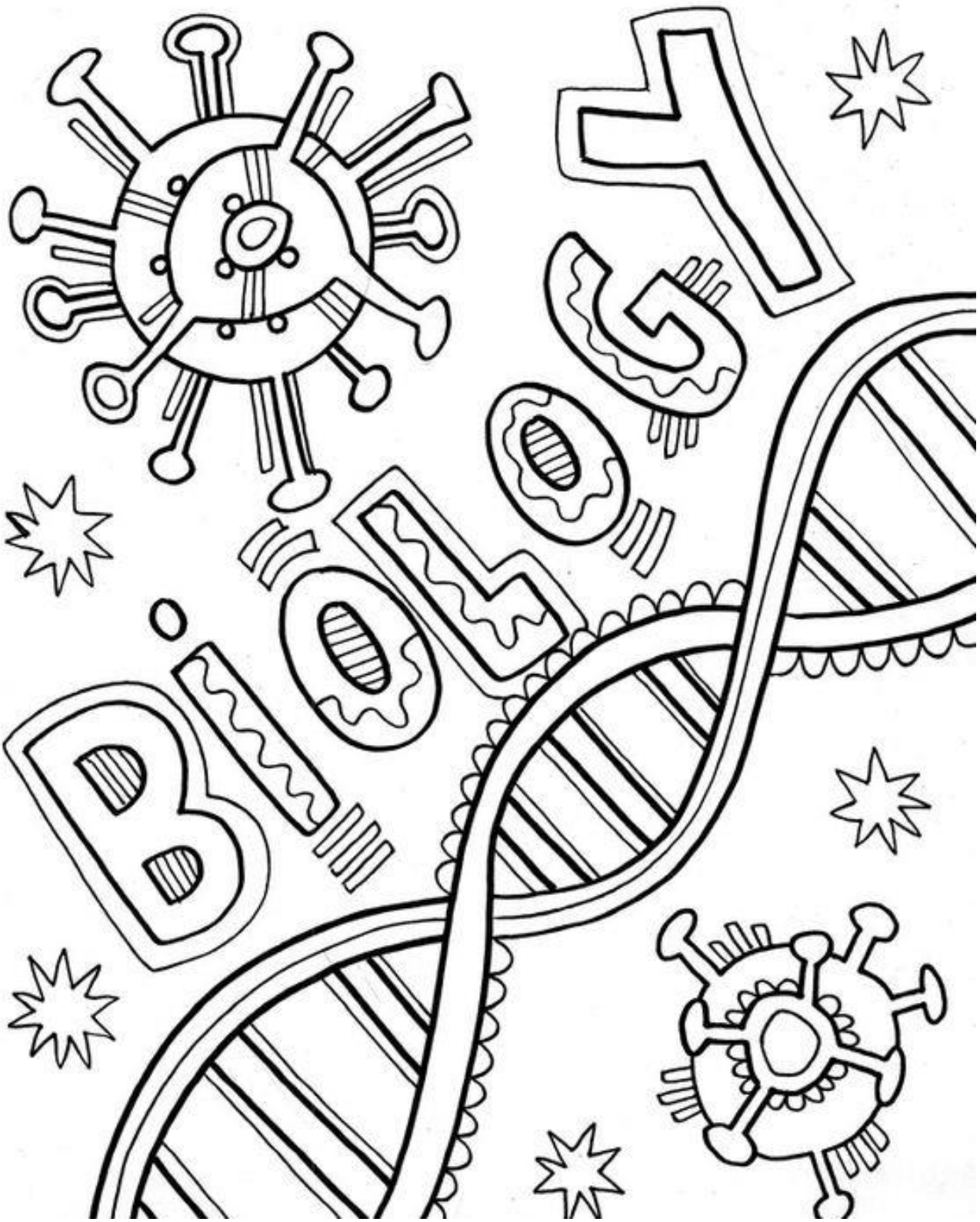

BIOLOGY

L1. Photosynthesis

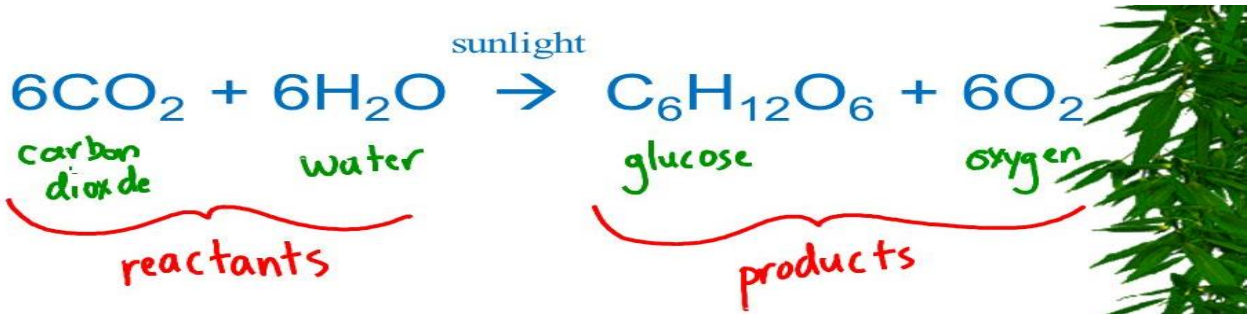
Green plants and algae make their own food in a process called **photosynthesis**. **Photosynthesis** is an **endothermic** process.

Almost all life on Earth depends upon this process. Photosynthesis is also important in maintaining the levels of oxygen and carbon dioxide in the atmosphere.

Here is the word equation for photosynthesis:

carbon dioxide + water (+ light energy) → glucose + oxygen

Here is the balanced symbol equation for photosynthesis:

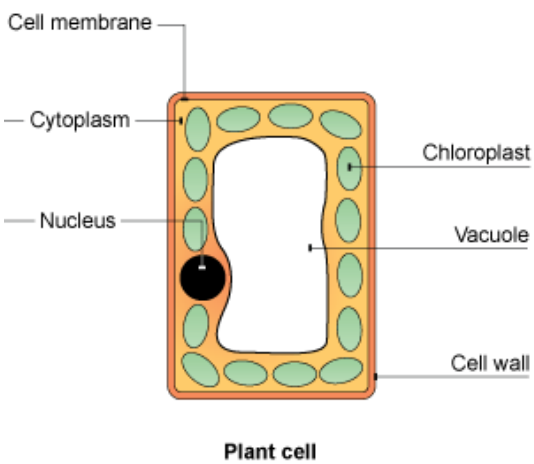


Photosynthesis takes place inside plant cells in structures called **chloroplasts**. Chloroplasts contain a green substance called **chlorophyll**. This absorbs the light energy needed to make photosynthesis happen.

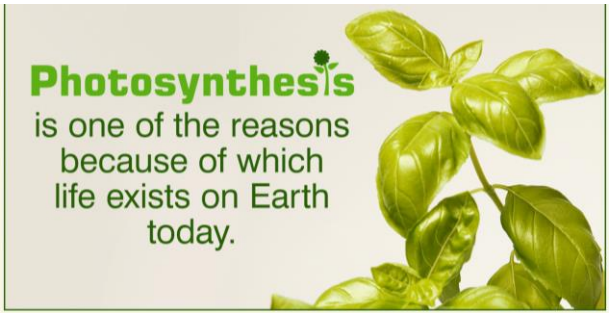
Using glucose

The glucose made in photosynthesis is transported around the plant as soluble sugars.

Glucose is used in **respiration** to release energy for use by the plant's cells. However, glucose is converted into **insoluble starch** for storage.

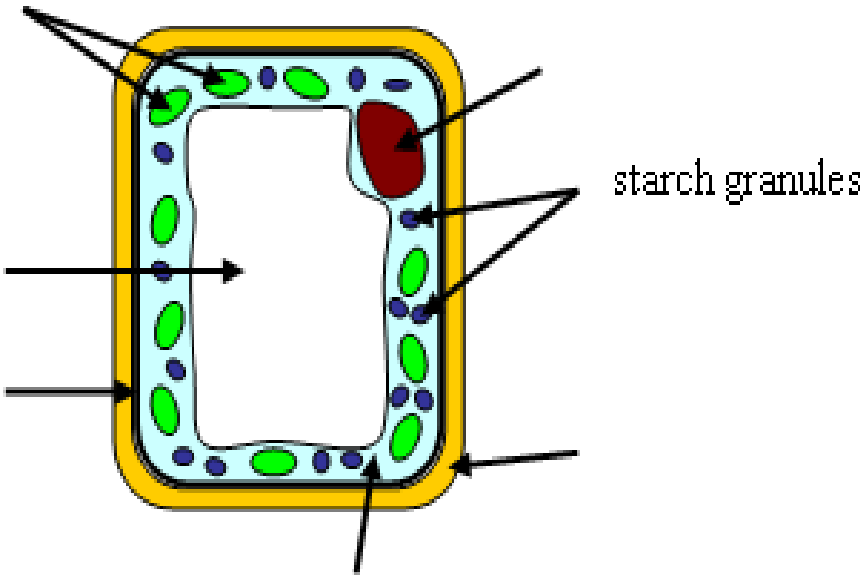


Plant cell



L1. Photosynthesis activities

Task 1: Label the diagram of the plant cell below



Task 2: Write the chemical formula for the products and reactants of photosynthesis

Compound	Chemical formula
Oxygen	
Carbon dioxide	
Water	
Glucose	

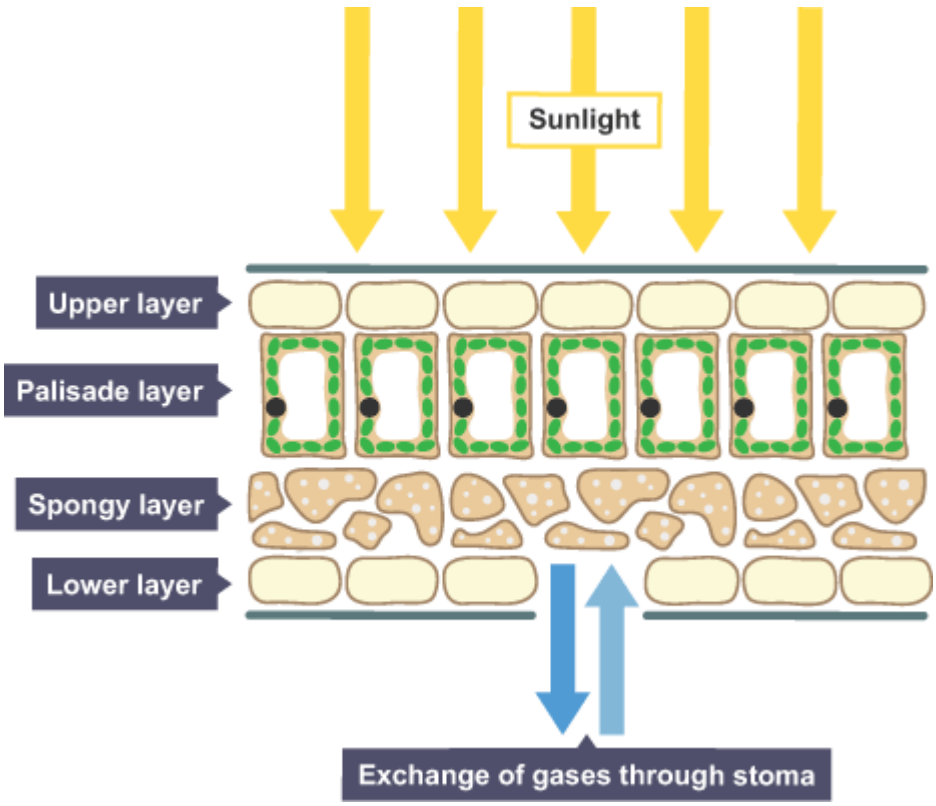
Task 3: Match up the keyword to its definition

Photosynthesis	A green substance that absorbs light energy.
Chlorophyll	Energy is taken in from the surroundings.
Chloroplast	Endothermic reaction in chloroplasts that uses light energy to react carbon dioxide and water to produce glucose and oxygen
Glucose	Small organelle that contains chlorophyll.
Endothermic	A simple sugar made by plants and used in respiration.

L2. Adaptations of the leaf for photosynthesis

The leaf is a plant organ adapted to carry out photosynthesis. The table describes some of its adaptations:

Adaptations	Functions
Thin leaves	Allows sunlight to reach the palisade cells
Contains lots of chlorophyll	Absorbs the sunlight needed for photosynthesis
Stomata	Allow carbon dioxide to move by diffusion into the leaf
Xylem and phloem	Xylem to transport water and phloem transports sugars (glucose)
Layer of palisade cells on the top	To absorb sunlight



L2. Leaf adaptations activities

Task 1: look – cover – write – check

Word/definition/information	1st try	2nd try
For example: Thin leaf - Allows sunlight to reach the palisade cells	Thin leaf - Allows sunlight to reach the palisade cells	Thin leaf - Allows sunlight to reach the palisade cells

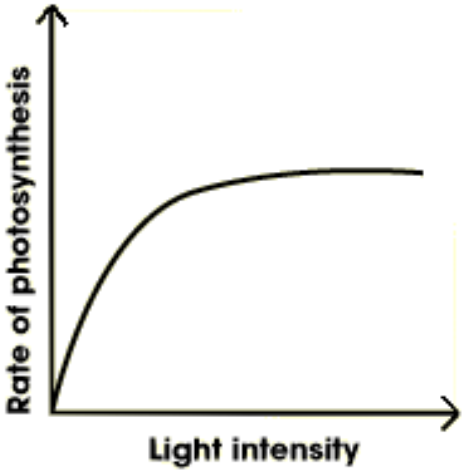
Task 2: Spelling practise: Look, say, cover, write, check

Look	Say	Cover	Write	Check	Write	Check	Write	Check
Example			exampel	×	example	✓	example	✓
Palisade								
Chloroplast								
Adaptation								
Photosynthesis								
Xylem								
Phloem								
Stomata								
Chlorophyll								

L3. Factors limiting photosynthesis

Three factors can limit the speed of photosynthesis - light intensity, carbon dioxide concentration and temperature. A limiting factor is a factor which limits the maximum amount of photosynthesis taking place.

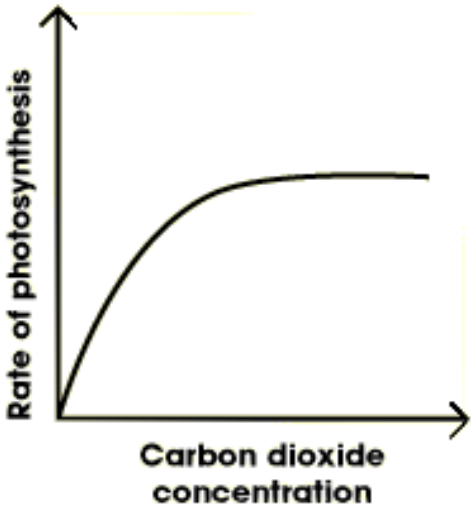
1) Light intensity



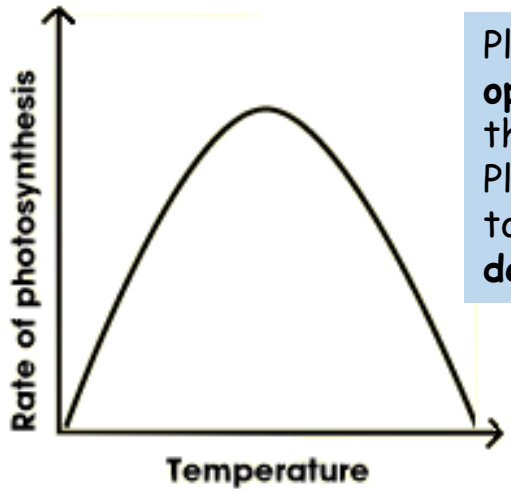
Without enough light, a plant cannot photosynthesise quickly, even if there is plenty of water and carbon dioxide. Increasing the light intensity will increase the speed of photosynthesis

2) Concentration of carbon dioxide

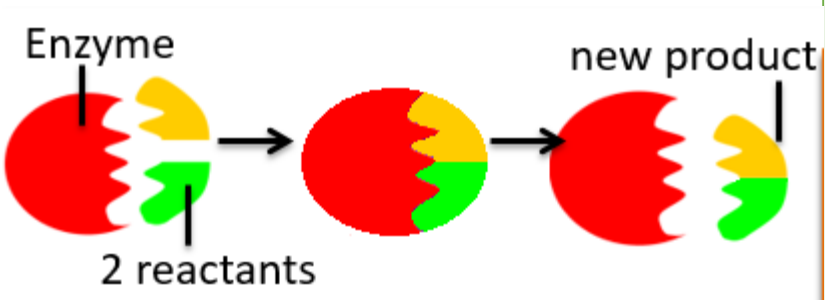
Sometimes photosynthesis is limited by the concentration of carbon dioxide in the air. Even if there is plenty of light, a plant cannot photosynthesise if there is insufficient carbon dioxide.



3) Temperature



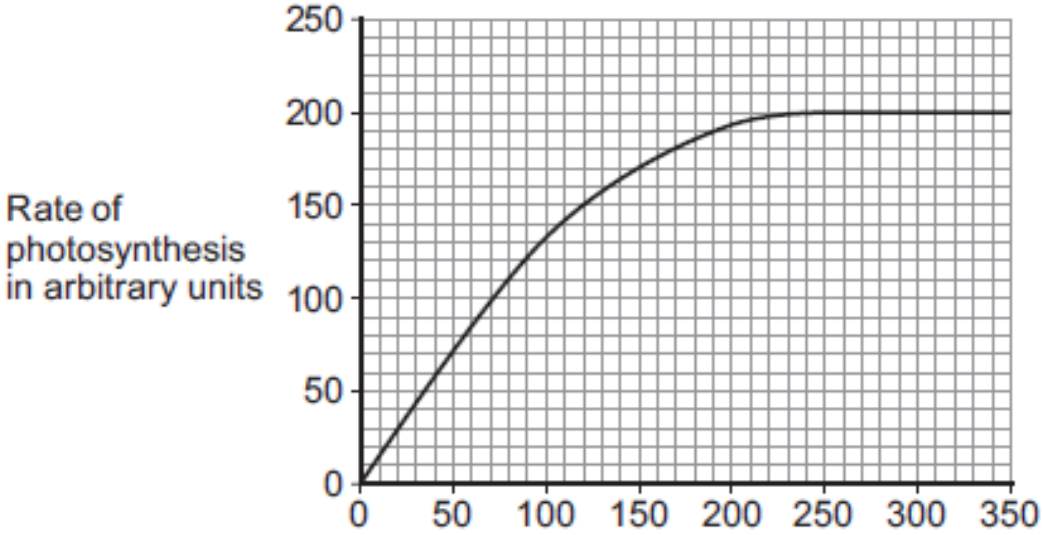
Plants photosynthesis at best at their **optimum** temperature. If it gets too cold, the rate of photosynthesis will decrease. Plants cannot photosynthesise if it gets too hot because enzymes will start to **denature** (their shape will be changed).



As temperature rises the enzyme is denatured, This means that the active site is damaged so no reaction can occur

L3. Factors limiting photosynthesis activities

Task:1 Answer the exam questions below



Describe the effect of increasing light intensity on the rate of photosynthesis.
You should include numbers from **Figure 3** in your description.

_____

_____

_____

_____ **(3)**

(b) At a light intensity of 250 arbitrary units, light is **not** a limiting factor of photosynthesis.

(i) What is the evidence for this in **Figure 3**?

_____

_____ **(1)**

(ii) Give **two** factors that could be limiting the rate of photosynthesis at a light intensity of 250 arbitrary units.

1. _____
2. _____ **(2)**

Task 2: Answer the questions below

1) Photosynthesis is affected by limiting factors. What is meant by the term 'limiting factor'?

_____

_____

2) Write down the word equation for photosynthesis

_____

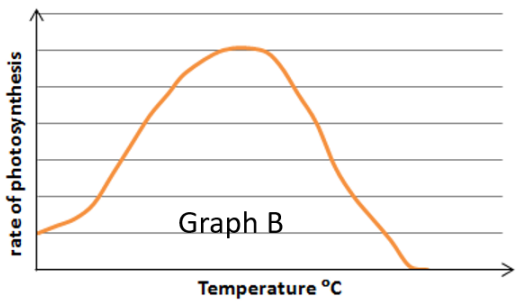
3) Name the green pigment present in plant cells.

_____

4) What is the role of this green pigment?

_____

5) For the graph below - identify what the limiting factor(s) might be in the experiment.



_____

_____

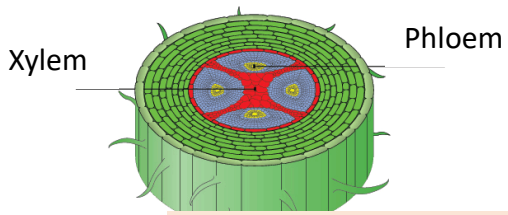
_____

_____

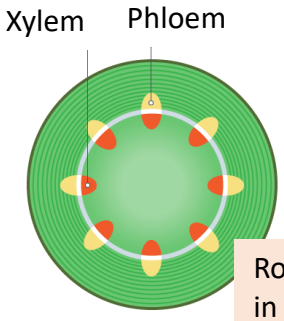
L4. Transport in plants

Plants have **two** different types of **transport tissue**, the xylem and the phloem are the main **plant tissues**.

1) **Xylem** transports water and solutes from the roots to the leaves.
2) 2) **Phloem** transports food from the leaves to the rest of the plant.



Root - xylem and phloem in the centre of the root.



Root - xylem and phloem in the centre of the stem

Xylem

Xylem vessels are involved in the movement of water through a plant from its roots to its leaves. Water:

Is absorbed from the soil through root hair cells

Is transported through the xylem vessels up the stem to the leaves

Evaporates from the leaves (this process is known as transpiration) which results in more water being drawn up from the roots

Phloem

Phloem vessels are involved in *translocation*. This is the movement of food (dissolved sugars) substances from the stems to growing tissues and storage tissues.

Xylem and phloem

Xylem vessels consist of dead cells. They have a thick, strengthened cellulose cell wall with a hollow *lumen*. On the other hand, phloem consists of columns of living cells.

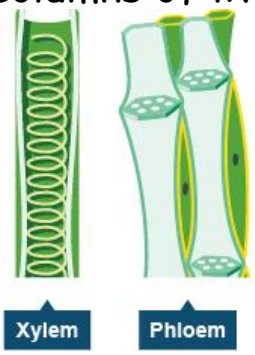


Diagram showing the cross sections of a xylem and a phloem

L4. Transport in plants activates

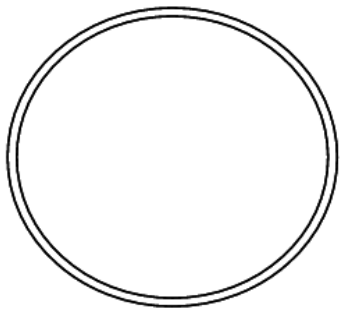
Task 1: Complete the paragraph below using the words given. All words are used only once

Word bank: downwards, water, amino, leaves, mineral, stems, long, leaves, vascular, up xylem, translocation, glucose, roots

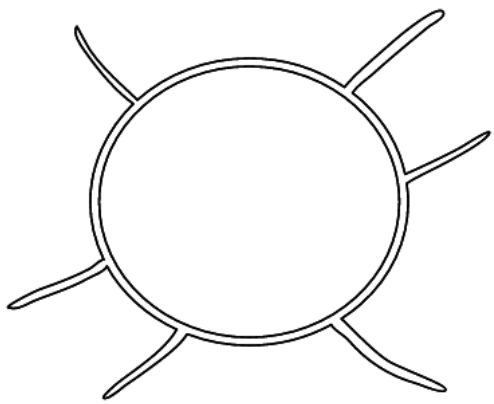
Plants have a transport system in order to move substances relatively _ _ _ _ distances from one location to another. The _ _ _ _ _ tissue is responsible for moving _ _ _ _ _ and dissolved _ _ _ _ _ _ _ _ ions. Movement is always _ _ the plant, from the roots, through the stem and into the _ _ _ _ _ _. Phloem on the other hand transports dissolved _ _ _ _ _ _ _ and _ _ _ _ _ acids in the plant. This process is known as _ _ _ _ _ _ _ _ _ _ _ _ _ _ and movement in the phloem can be either upwards or _ _ _ _ _ _ _ _ _. Xylem and phloem tissue are found in the _ _ _ _, _ _ _ _ _ and _ _ _ _ _ _

Task 2: Complete the two diagrams below to show the arrangement of the xylem and the phloem in both the stem and the root of a plant

1. Vascular tissue in the stem



2. Vascular tissue in the root



L5. Transpiration

Transpiration explains how **water** moves up the plant **against gravity** in tubes made of dead xylem cells without the use of a pump.

Water on the surface of the leaf evaporates. This is called **transpiration**. More water is drawn out of the xylem cells inside the leaf to replace what's lost. As the xylem cells make a **continuous tube** from the leaf, down the stem to the roots, this acts like a drinking straw, producing a **flow** of water and dissolved minerals from roots to leaves.

Factors that speed up transpiration will also increase the rate of water uptake from the soil. When water is scarce, or the roots are damaged, it increases a plant's chance of survival if the transpiration rate can be **slowed down**. Plants can do this themselves by **wilting**, or it can be done artificially, like removing some of the leaves from cuttings before they have chance to grow new roots.

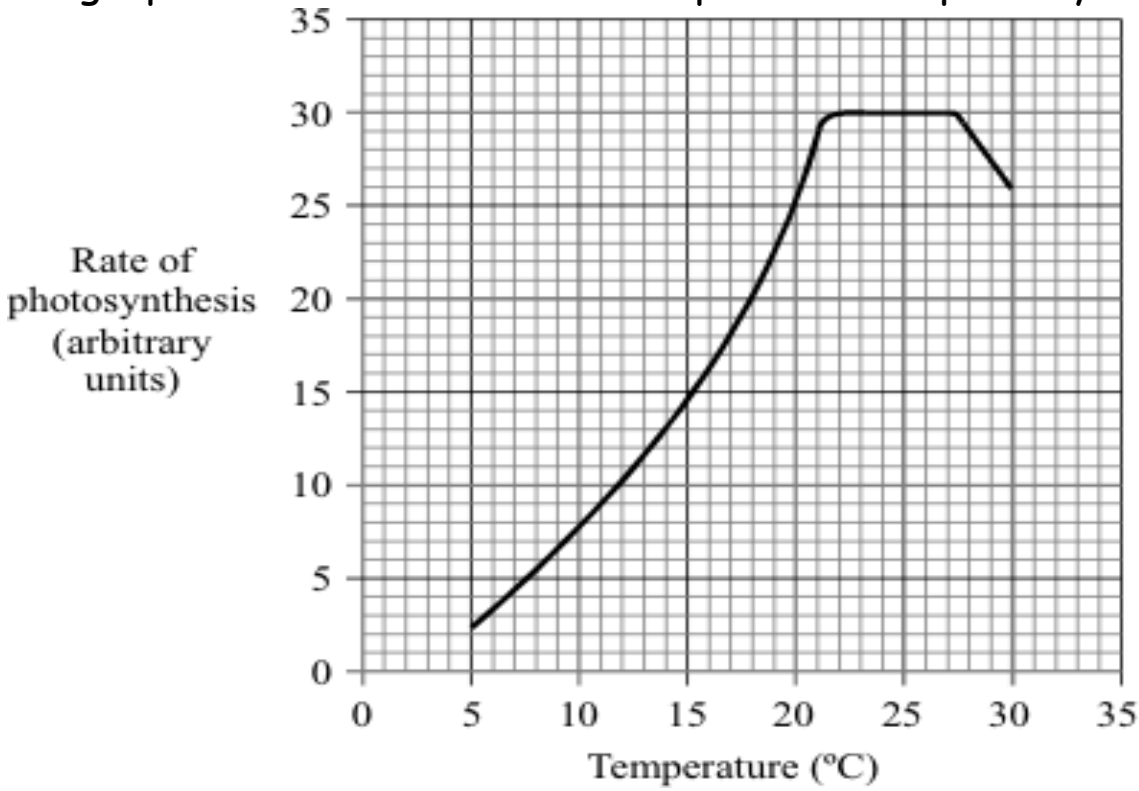
Factors that affect transpiration rate

Factor	Description	Explanation
Light	In bright light transpiration increases	The stomata (openings in the leaf) open wider to allow more carbon dioxide into the leaf for photosynthesis
Temperature	Transpiration is faster in higher temperatures	Evaporation and diffusion are faster at higher temperatures
Wind	Transpiration is faster in windy conditions	Water vapour is removed quickly by air movement, speeding up diffusion of more water vapour out of the leaf
Humidity	Transpiration is slower in humid conditions	Diffusion of water vapour out of the leaf slows down if the leaf is already surrounded by moist air

L5. Factors affecting transpiration activates

Task 1: Complete the exam question below

Q1. The graph shows the effect of temperature on photosynthesis.



(a) Between which temperatures is the rate of photosynthesis fastest?

_____ and _____ °C **(1)**

(b) Suggest why the rate of photosynthesis stays the same between these two temperatures.

_____

_____

_____ **(2)**

(c) A greenhouse owner wants to grow lettuces as quickly and cheaply as possible in winter.

At what temperature should he keep his greenhouse in order to grow the lettuces as quickly and cheaply as possible?

_____ °C

Explain your answer.

_____

_____

_____

_____ **(3)**

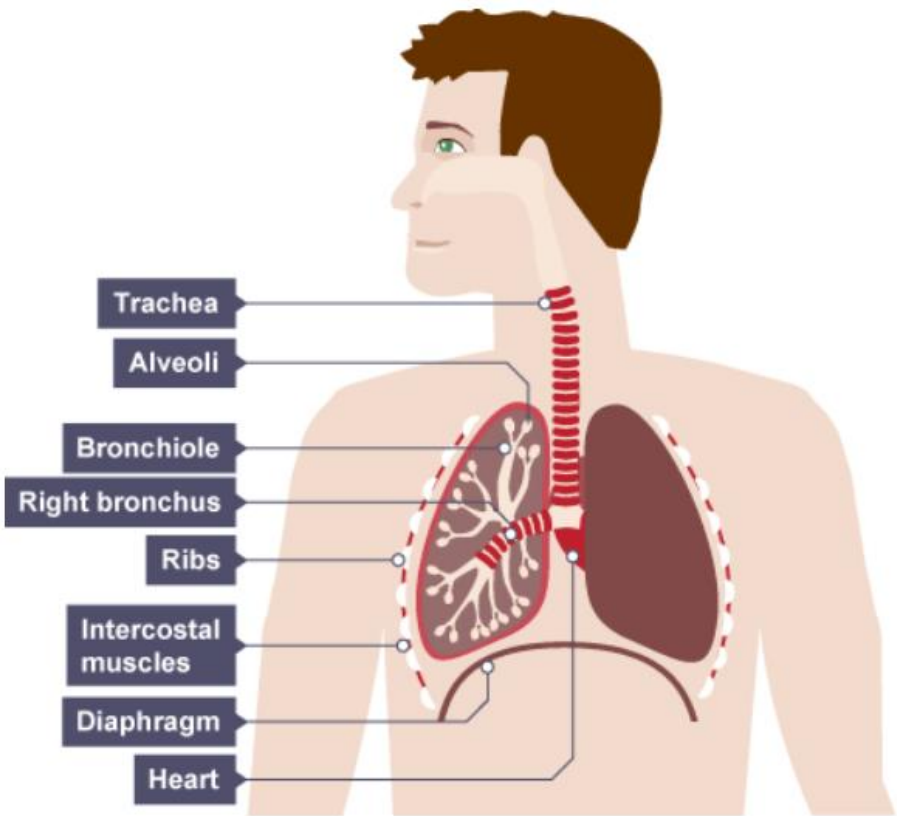
L1. Respiration

Respiration is a chemical reaction that happens in all living cells, including plant cells and animal cells. It is the way that energy is released from glucose so that all the other chemical processes needed for life can happen. Do not confuse respiration with breathing (which is properly called ventilation).

Energy is released in the reaction. The **mitochondria**, found in the cell cytoplasm, are where most respiration happens. Respiration is an **exothermic** reaction as heat is released.

Energy is needed for life processes such as:

- Growth and repair
- Movement
- Control of body temperature in mammals



Structures in the respiratory system

L1. Respiration activities

Task 1: Complete the sentences below

1) Respiration produces useful _ _ _ _ _ _ in the cells.

2) We need energy to _ _ _ _ and to keep warm.

3) The main food substance that is used in respiration is _ _ _ _ _ _ _

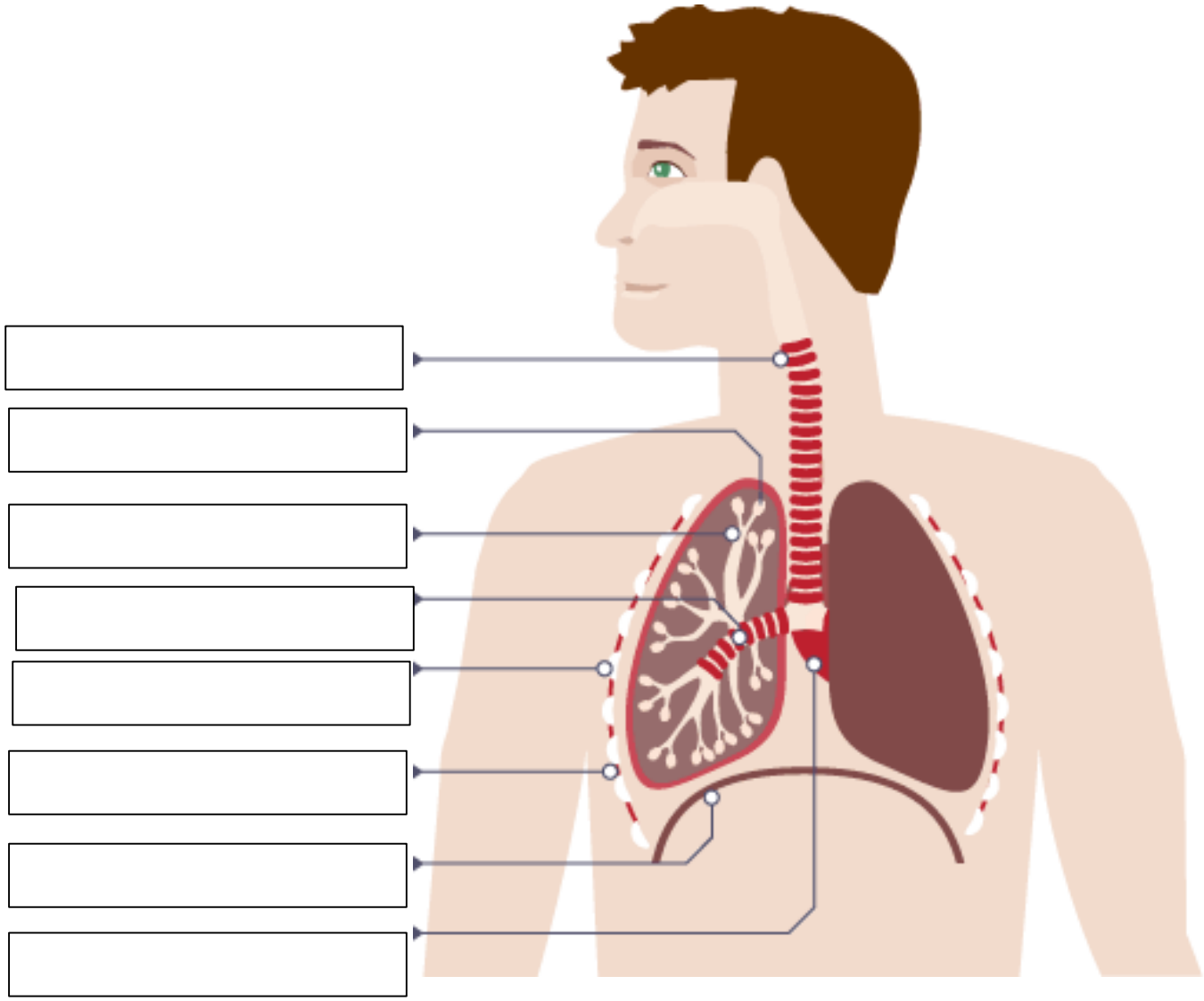
4) _ _ _ _ _ _ _ is a similar process to respiration but it happens much more quickly.

5) The waste gas produced by respiration is C _ _ _ _ _ D _ _ _ _ _ _

6) We get rid of carbon dioxide by _ _ _ _ _ _ _ _ _ it out.

7) If plants did not make _ _ _ _ _ _ gas we would soon use it all up.

Task 2: label the diagram below



L2. Aerobic and anaerobic respiration

Aerobic respiration

Glucose and oxygen react together in cells to produce carbon dioxide and water and releases energy. The reaction is called **aerobic respiration** because oxygen from the air is needed for it to work.

Here is the word equation for aerobic respiration:

glucose + oxygen → carbon dioxide + water (+ energy)

Anaerobic respiration

During hard exercise, not enough oxygen can reach your muscle cells. So, aerobic respiration is replaced with **anaerobic respiration**. This does not need oxygen for it to happen.

Here is the word equation for anaerobic respiration in humans:

glucose → lactic acid (+ little energy)

	Aerobic	Anaerobic
Needs oxygen?	Yes	No
Needs glucose?	Yes	Yes
Product(s) formed	Carbon dioxide and water	Lactic acid

Muscle fatigue

Muscles become fatigued (tired) during long periods of vigorous activity. This means that they stop contracting efficiently. One cause of this is the build-up of lactic acid in the muscles from anaerobic respiration. The lactic acid is removed from the muscles by blood flowing through them.

Oxygen debt

Much less energy is released during anaerobic respiration than during aerobic respiration. This is because the breakdown of glucose is incomplete.

Anaerobic respiration produces an **oxygen debt**. This is the amount of oxygen needed to *oxidise* lactic acid to carbon dioxide and water. The existence of an oxygen debt explains why we continue to breathe deeply and quickly for a while after exercise.

L2. Aerobic and anaerobic respiration activities

Task 1: Complete the table below

	Aerobic	Anaerobic
Needs oxygen?		
Needs glucose?		
Product(s) formed		

Task 2: Complete the passage using the following words, you can use the words more than once: Aerobic, Anaerobic, carbon, Energy, enough, glucose, poisonous, lactic acid little not all, not enough, oxygen, oxygen debt, pant, water

Organisms respire in order to release energy. …… respiration is respiration requiring …… In aerobic respiration the reactants are …… and …… The products are water and …… dioxide. …… is also released.

Glucose + oxygen → carbon dioxide + water + **ENERGY**

…… respiration is respiration without oxygen. Anaerobic respiration takes place when there is ……oxygen available but energy is required. This happens when an athlete runs very fast but the body cannot supply …… oxygen.
In anaerobic respiration the reactant is only …… The product is …… ……
A …… energy is released. This is because not all the energy is released from each glucose molecule.

Glucose → lactic acid + **energy**

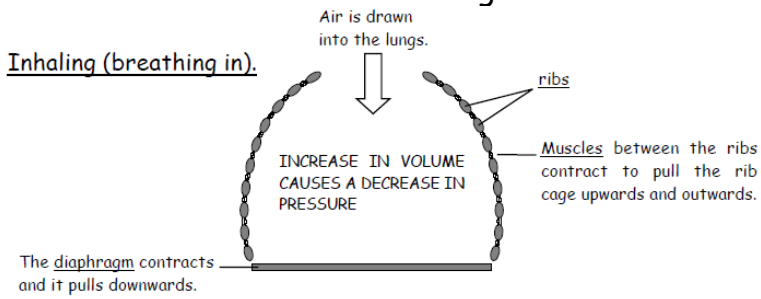
Lactic acid is ……

To get rid of lactic acid the person will …… in order to get a good supply of oxygen.
You have to keep breathing hard for a while after you stop to get oxygen into your muscles to convert the painful lactic acid which has built up to harmless……dioxide. The amount of oxygen required to do this is called …… .....

L3. adaptation for gas exchange

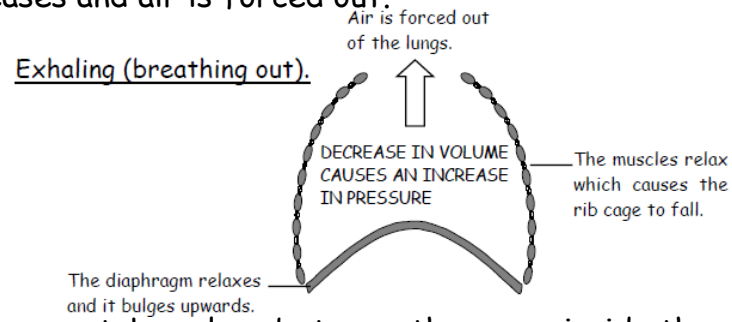
When you inhale:

1. The *intercostal muscles* contract, expanding the ribcage outwards and upwards.
2. The *diaphragm* contracts, pulling downwards to increase the volume of the chest.
3. Pressure inside the chest is lowered and air is sucked into the lungs.



When you exhale:

1. The intercostal muscles relax, the ribcage drops inwards and downwards.
2. The diaphragm relaxes, moving back upwards, decreasing the volume of the chest.
3. Pressure inside the chest increases and air is forced out.

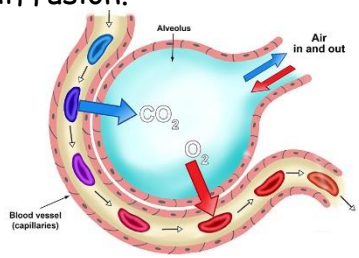


Gas exchange

Within the *alveoli*, an exchange of gases takes place between the gases inside the alveoli and the blood.

Blood arriving in the alveoli has a higher carbon dioxide concentration which is produced during *respiration* by the body's cells. However, the air in the alveoli has a much lower concentration of carbon dioxide, meaning there is a *concentration gradient* which allows carbon dioxide to *diffuse* out of the blood and into the alveolar air.

Similarly, blood arriving in the alveoli has a lower oxygen concentration (as it has been used for respiration by the body's cells), while the air in the alveoli has a higher oxygen concentration. Therefore, oxygen moves into the blood by diffusion.



Adaptations of the alveoli

To maximise the efficiency of gas exchange, the alveoli have several adaptations:

- They are folded, providing a much greater *surface area* for gas exchange to occur.
- The walls of the alveoli are only one cell thick. This makes the exchange surface very thin - shortening the diffusion distance across which gases have to move.
- Each alveolus is surrounded by blood *capillaries* which ensure a good blood supply. This is important as the blood is constantly taking oxygen away and bringing in more carbon dioxide.

L3. adaptation for gas exchange activities

Task 1: Complete the sentences below

1) The diaphragm is a sheet of M _ _ _ _ _

2) The word I _ _ _ _ _ means to breathe in.

3) The word E _ _ _ _ _ means to breathe out.

4) The diaphragm and rib muscles both C _ _ _ _ _ _ _ during inhaling.

5) The V _ _ _ _ _ of the chest increases when we inhale.

6) Air is drawn into the lungs due to a D _ _ _ _ _ _ _ in pressure.

7) The diaphragm and rib muscles both R _ _ _ _ during exhaling.

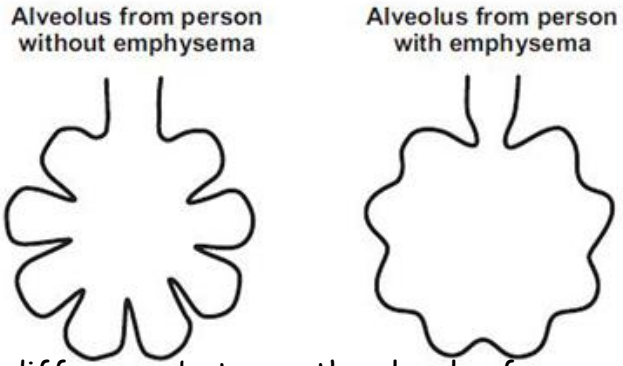
8) Air is forced out of the lungs due to an I _ _ _ _ _ _ _ in pressure.

Task 2: Fill in the missing words in the passage using the words provided: trachea, oxygen, capillaries, cartilage, bronchus, alveoli, blood

The lungs absorb …… gas and excrete waste carbon dioxide. The air is drawn in through the …… (windpipe) which is kept open at all times by rings of a bony material called …… The trachea divides into the right and left …… which branch out into narrower tubes called bronchioles. The bronchioles end in tiny air sacs called …… The alveoli have very thin walls and are surrounded by …… Here oxygen is absorbed into the …… and carbon dioxide passes into the alveoli.

Task 3: Answer the question below

Q1.Emphysema is a disease affecting the lungs. People with emphysema are often short of breath and find exercise difficult. The diagram below shows an alveolus from a person without emphysema and an alveolus from a person with emphysema.



(a) Describe **one** difference between the alveolus from a person without emphysema and the alveolus from a person with emphysema.

_____

_____ **(1)**

L4. Affect of smoking on respiratory system

Effects of smoking

Smoking can cause lung disease, heart disease and certain cancers.

Nicotine is the addictive substance in tobacco. It quickly reaches the brain and creates a dependency so that smokers become addicted

Warnings such as 'Smoking kills' are used to deter people from smoking

Effects on the air passages

Sticky mucus in the lungs traps **pathogens**. The mucus is normally swept out of the lungs by the **cilia** on the **epithelial cells** lining the trachea, **bronchi** and **bronchioles**. However, cigarette smoke contains harmful chemicals that damage these cells, leading to a build-up of mucus and a smoker's cough. Smoke irritates the bronchi, causing **bronchitis**.

Effects on the alveoli

Smoke damages the walls of the **alveoli**. The alveoli walls break down and join together, forming larger air spaces than normal. This reduces the efficiency of gas exchange, so people with the lung disease **emphysema** (a type of COPD or chronic obstructive pulmonary disease) carry less oxygen in their blood and find even mild exercise difficult.

Carbon monoxide

Carbon monoxide, CO, combines with the **haemoglobin** in red blood cells. This reduces the ability of the blood to carry oxygen, putting strain on the **circulatory system** and increasing the risk of **coronary heart disease** and strokes.

Lung cancer

Carcinogens are substances that cause cancer. Tobacco smoke contains many carcinogens, including tar. Smoking increases the risk of lung cancer, and cancer of the mouth, throat and oesophagus.

Section through a healthy lung and section through a smoker's lung, with tar deposits visible

L5. Affect of exercise on respiratory system

Effect of exercise on breathing

During exercise, the muscle cells respire more than they do at rest. This means:

Oxygen and glucose must be delivered to them more quickly

Waste carbon dioxide must be removed more quickly

This is achieved by increasing the breathing rate and heart rate. The increase in heart rate can be detected by measuring the pulse rate. The stroke volume also increases – this is the volume of blood pumped each beat. The total cardiac output can be calculated using the equation:

Cardiac output = stroke volume x heart rate

During hard exercise, the oxygen supply may not be enough for the needs of the muscle cells. When this happens, anaerobic respiration takes place, as well as aerobic respiration.

Fitness versus health

Fit people are able to carry out physical activities more effectively than unfit people. Their **pulse rate** is likely to return to normal more quickly after exercise.

But being fit is not the same as being healthy. Healthy people are free from disease and infection: they may or may not be fit as well. It is possible to be fit but unhealthy, or healthy but unfit.

Lesson 4/5 activities

Task 1: Complete the sentences below

1) Dirt and germs in the air you breathe are trapped by M _ _ _ _

2) Ciliated cells have tiny H _ _ _ _ to waft up the dirty mucus.

3) Any germs that are swallowed are killed by the A _ _ _ in the stomach.

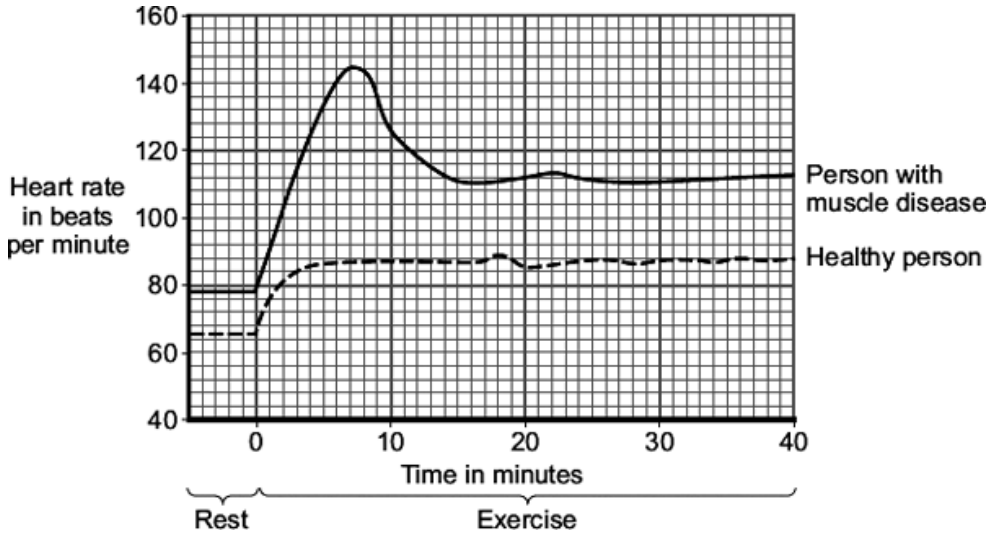
4) Cigarette smoke stops the cilia B _ _ _ _ _ _

5) A smoker may have less O _ _ _ _ _ in their blood.

6) Tar from cigarette smoke causes C _ _ _ _ _

Task 2: Complete the questions below

Q1. Two people did the same amount of gentle exercise on an exercise cycle. One person had a muscle disease and the other had healthy muscles he graph shows the effect of the exercise on the heart rates of these two people.



(a) Describe **three** ways in which the results for the person with the muscle disease are different from the results for the healthy person.
To gain full marks in this question you need to include data from the graph in your answer.

1. _____
2. _____
3. _____ **(3)**

(b) The blood transports glucose to the muscles at a faster rate during exercise than when a person is at rest.

(i) Name **one** other substance that the blood transports to the muscles at a faster rate during exercise.

_____ **(1)**

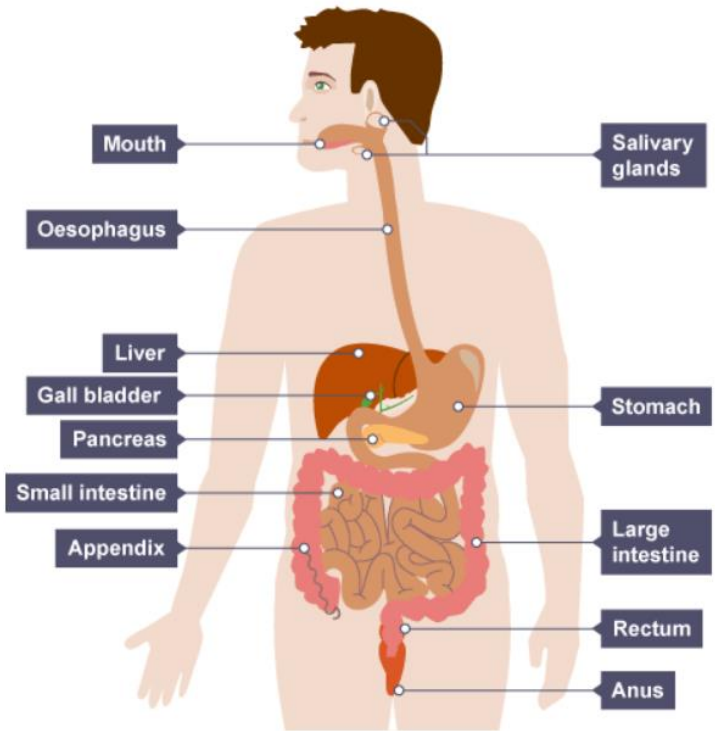
(ii) People with the muscle disease are not able to store glycogen in their muscles.
The results shown in the graph for the person with the muscle disease are different from the results for the healthy person.
Suggest an explanation for the difference in the results.

_____
_____
_____
_____ **(3)**

L1. Digestive system

The food we eat has to be broken down into other substances that our bodies can use. This is called **digestion**. Without digestion, we could not absorb food into our bodies and use it.

The picture below shoes the organs which make up the digestive system

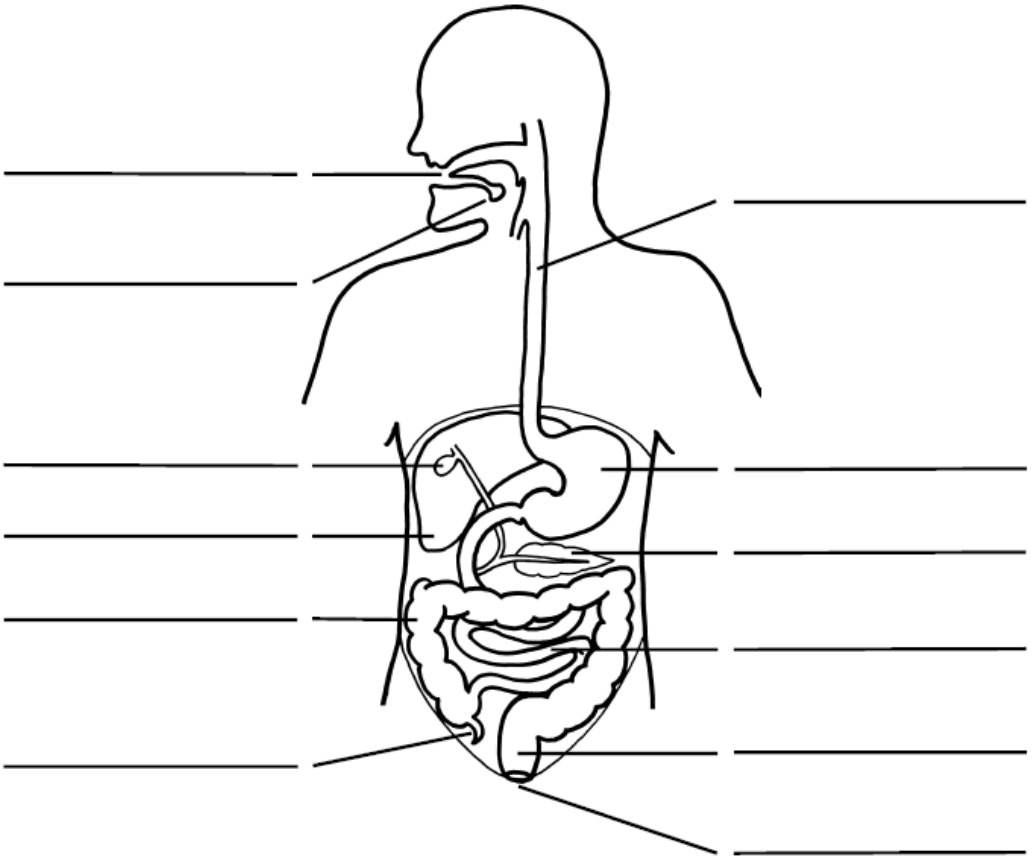


The table shows the main structures and their functions

Structure	Function
Mouth	Where food enters the alimentary canal and digestion begins
Salivary glands	Produce saliva containing amylase
Oesophagus	Muscular tube which moves ingested food to the stomach
Stomach	Muscular organ where digestion continues
Pancreas	Produces digestive enzymes
Liver	Produces bile
Gall bladder	Stores bile before releasing it into the duodenum
Small intestine – (ileum)	Where digested food is absorbed into the blood and lymph
Large intestine – (colon)	Where water is reabsorbed
Rectum	Where faeces are stored
Anus	Where faeces leave the alimentary canal

L1. Digestive system activities

Task 1: Label the diagram below with the organs of the digestive system



Task 2: Read the descriptions and state which organ conducts that function, use the word bank to help you

Word bank: Liver, Gullet, Small intestine, Pancreas, Stomach, Large intestine, Appendix, Mouth, Rectum

Organ	Description
	Here the food is chewed and moistened with saliva. The food is shaped into a round ball before it is swallowed.
	This is a tube that squeezes the food down to the stomach.
	This is a bag that churns up the food. It contains gastric juice and hydrochloric acid. Gastric juice contains an enzyme that digests protein. The acid kills germs.
	This is a very long tube that the food passes into after it leaves the stomach. Here the food is completely digested and then it is absorbed through the walls and into the blood stream.
	This is a small leaf-shaped organ. It makes pancreatic juice which passes into the small intestine. This juice contains an alkali that helps to neutralise the acid from the stomach. It also contains several enzymes.
	This organ makes a chemical called BILE which is stored in a small bag called the GALL BLADDER. The bile is squeezed into the small intestine where it helps to break up large pieces of fat.
	This is a wide tube that the undigested food passes through. Water is absorbed from this back into the body.
	This organ has no function in humans but it helps with digestion of plant material in herbivores such as sheep. It sometimes becomes infected in humans and then it must be removed.
	The dried out waste food material is stored here until it is ready to be passed out of the body through the anus.

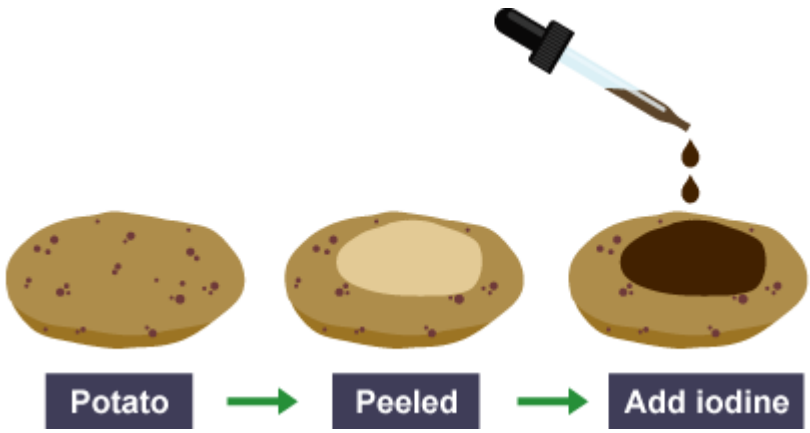
L2/3. Chemical tests

There are different tests which can be used to detect carbohydrates, proteins and lipids.

Carbohydrates

Starch is detected using **iodine solution**. This turns blue-black in the presence of starch.

We can test a potato for starch using iodine if the iodine turns blue-black then starch is present



Reducing sugars are detected using **Benedict's solution**. Reducing sugars include:

monosaccharides - such as glucose and fructose

disaccharides - such as maltose

Benedict's solution gradually turns from blue to cloudy orange or brick red when heated with a reducing sugar. Sucrose is a non-reducing sugar and does not react with Benedict's solution.

Proteins

Proteins are detected using **Biuret reagent**. This turns a mauve or purple colour when mixed with protein.

Lipids

Lipids are detected using the **emulsion test**. This is what happens:

the test substance is mixed with 2 cm^3 of **ethanol**

an equal volume of distilled water is added

a milky-white **emulsion** forms if the test substance contains lipids

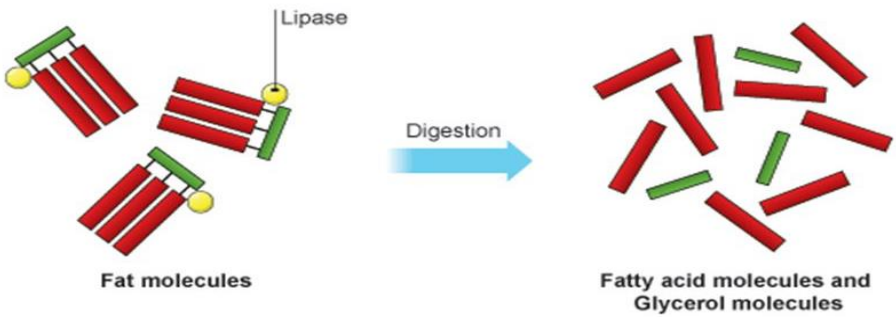
L4. Digestive enzymes

Digestion is the breakdown of insoluble molecules such as carbohydrates, proteins and fats (lipids) into small soluble substances to be absorbed into the blood. Substances are broken down using mechanical and chemical processes. **Mechanical digestion** includes:

- chewing in the mouth
- churning in the stomach

Chemical digestion involves **enzymes**. These are proteins that function as biological **catalysts**. Amylase, proteases and lipase are important enzymes involved in digestion.

- **Lipase** enzymes break down **fats** into **fatty acids** and **glycerol**.



The table below shows the substance each enzyme breaks down and the end product of the reaction.

Enzyme	Substance which it breaks down	End-products from the chemical breakdown	Where the enzyme is produced
Salivary amylase	Starch	Maltose	Salivary glands
Protease	Protein	Amino acids	Stomach, pancreas
Lipase	Lipids (fats and oils)	Fatty acids and glycerol	Pancreas
Maltase	Maltose	Glucose	Small intestine

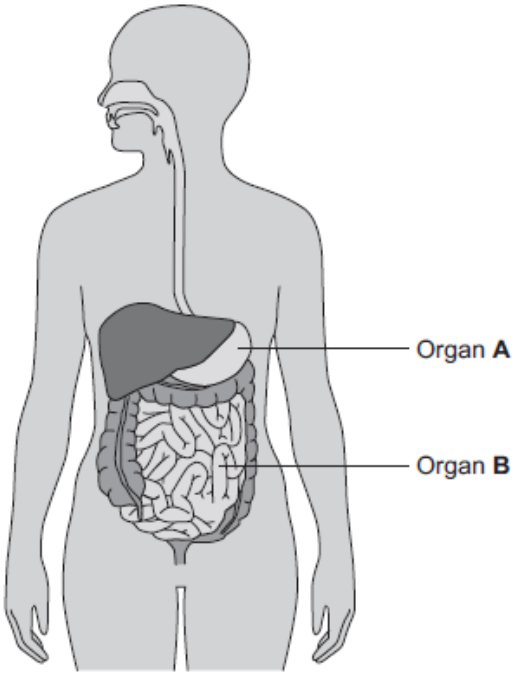
L4. Digestive enzymes activities

Task 1: Cross out the wrong answers

- Fats and oils are essential to our **diet/ food / suntan**.
- They are used in the **production / destruction / recycling** of cell membranes, for storing energy and for heat insulation.
- Lipase is produced in the **pancreas/ stomach / oesophagus**.
- The stomach pH is too **acidic / alkaline / salty** for it to work.
- Bile is needed to make a **paint / emulsion / mixture**.
- One product of fat digestion is **glucose / glycerol / gluey acid**.
- Fatty acids & glycerol are easily **absorbed / secreted / drip** into the blood stream

Task 2: Answer the questions below

Q1. The diagram below shows the human digestive system.



(a) (i) What is Organ **A**?
Draw a ring around the correct answer.
gall bladder **liver** **stomach** **(1)**

(ii) What is Organ **B**?
Draw a ring around the correct answer.
large intestine **pancreas** **small intestine** **(1)**

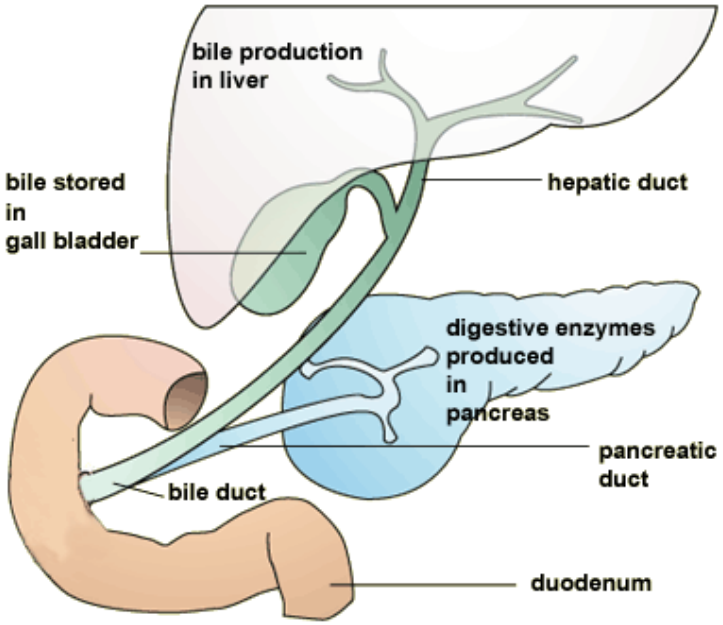
(b) Digestive enzymes are made by different organs in the digestive system.
Complete the table below putting a tick (✓) or cross (✕) in the boxes.
The first row has been done for you.

		Organ producing enzyme			
		salivary glands	Stomach	pancreas	small intestine
Enzyme	amylase	✓	✕	✓	✓
	lipase				
	protease				

(2)

L5. Digestive enzymes

Bile is an alkaline substance produced by the liver and stored in the gall bladder. It is secreted into the small intestine, where it emulsifies (breaks down) fats. This is important, because it provides a larger surface area in which the lipases can work.



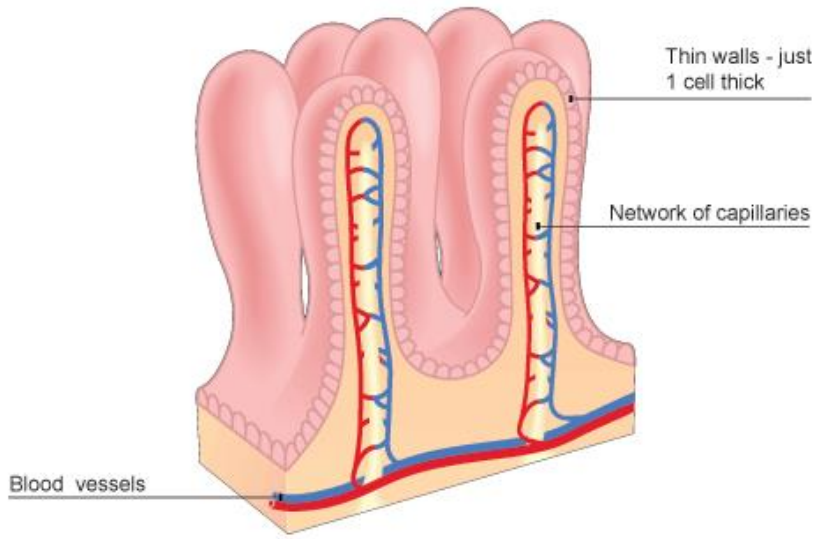
The intestines

Digested food molecules are **absorbed** in the **small intestine**. This means that they pass through the wall of the small intestine and into our bloodstream. Only small, soluble substances can pass across the wall of the small intestine. Large insoluble substances cannot pass through.

Absorption into bloodstream

The inside wall of the small intestine is **thin**, with a **large surface** area. This allows absorption to happen quickly and efficiently. To get a big surface area, the inside wall of the small intestine is lined with tiny **villi**. These stick out and give a big surface area. They also contain blood capillaries to carry away the absorbed food molecules.

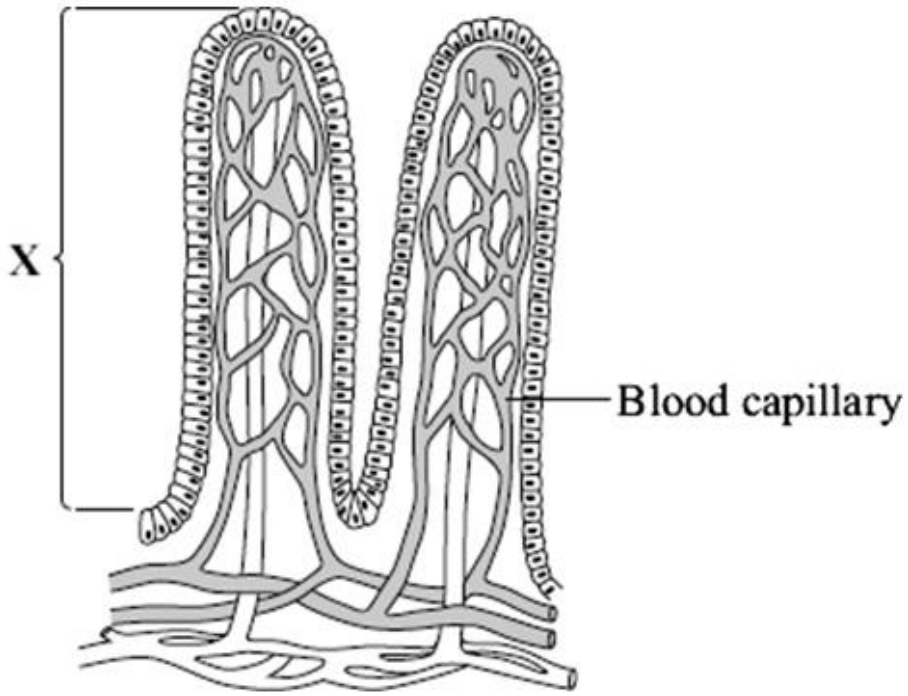
The villi have a rich blood supply. The blood supply has a lower concentration of food molecules and so *diffusion* occurs quickly.



L5. Digestive enzymes activity

Task: Answer the questions below

Q1. The diagram shows part of the lining of the small intestine.



(a) (i) Name structure **X**.
Draw a ring around **one** answer.

alveolus **thorax** **villus**

(ii) Choose **three** ways in which structure **X** is adapted to help the absorption of soluble food.
Tick (✓) **three** boxes.

It is ventilated. ☐

Its outer surface is one cell thick. ☐

It has a large surface area. ☐

It contains a layer of muscle. ☐

It has a good blood supply. ☐

Its cells contain haemoglobin. ☐

(b) Name the process by which soluble food enters the blood.
Draw a ring around **one** answer.

diffusion **fermentation** **transpiration**

L1. The blood

Blood: Blood is used to transport materials around the body, and to protect against disease. There are three different type of blood cells:

1. Red blood cells transport **oxygen**.
2. White blood cells protect against **disease**.
3. Blood platelets help the blood to **clot**.

Red blood cells

- These carry oxygen from the lungs to tissues. Oxygen transport is efficient because:
- There are **huge numbers** of red blood cells
- The cells have a flattened disc shape to increase **surface area** allowing rapid diffusion of oxygen
- They do **not have a nucleus** which allows them to transport more oxygen

White blood cells

- They **have** a nucleus
- They **fight against germs** that enter the blood

Platelets

- They do not have a nucleus
- They help blood to clot if the skin is cut

Blood plasma

- Plasma is a pale yellow liquid in which the blood cells float. It carries:
- Waste carbon dioxide from cells to lungs
- Dissolved food to cells
- Waste urea from the liver to the kidneys
- Hormones from one part of the body to another

Circulation

Blood is pumped at high pressure away from the heart in **arteries**. It travels through networks of thin **capillaries**, where it can **exchange** materials with the tissues. It's then collected up and returned to the heart at low pressure in **veins**.

How different blood vessels are adapted for their function

Blood vessel	Function	Adaptions
Artery	carry blood away from heart at high pressure	thick, elastic, muscular walls to withstand pressure and to exert force (pulse)
Capillary	allow exchange of materials between blood and tissues	thin permeable walls
Vein	return low pressure blood to heart	Large diameter to offer least flow resistance. Valves to prevent back flow.

L1. The blood activities

Task 1: fill in the missing words in the passage below, use the word bank to help you

Words bank: plasma, cut scabs, red, dissolved, germs, oxygen, platelets

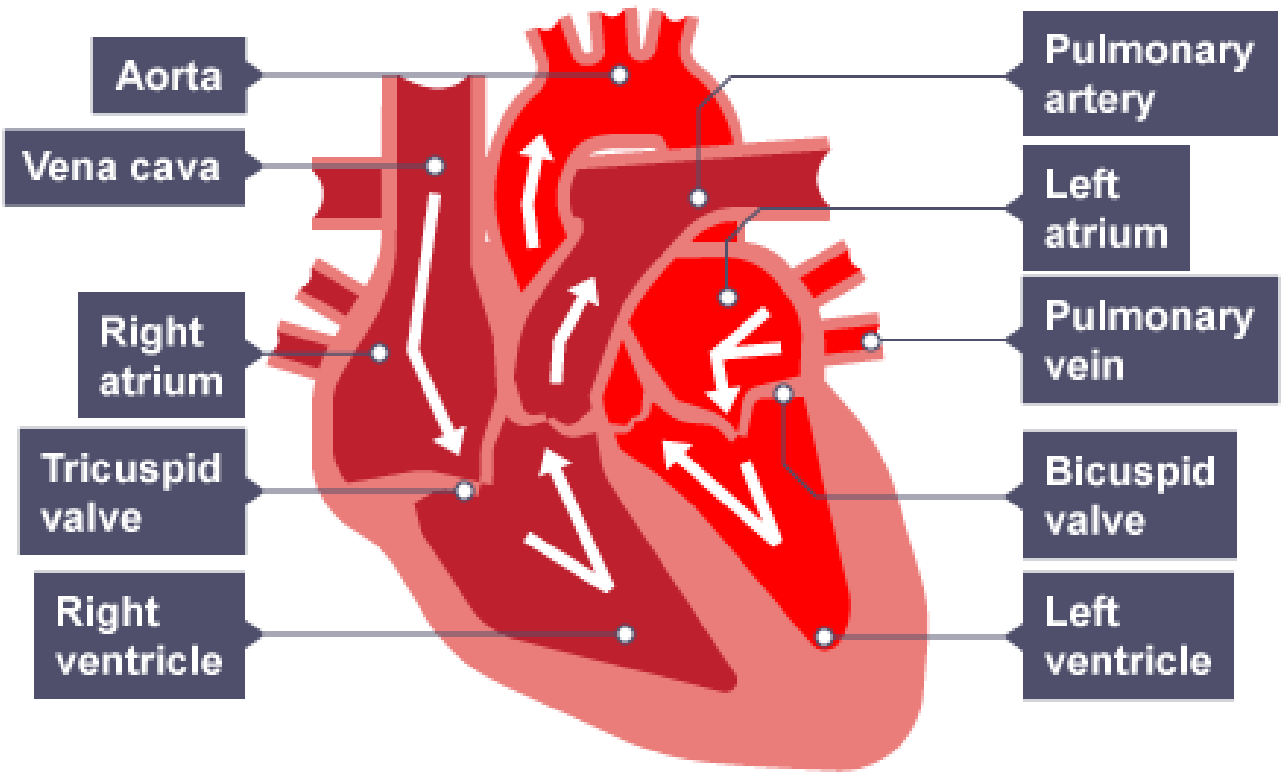
Blood is made of a pale yellow liquid called ..... and two different types of blood cell, white blood cells and ..... blood cells. Most of the chemicals in the blood are ..... in the plasma. ..... is carried by the red blood cells. The white blood cells help to destroy any ..... (bacteria and viruses) which may enter the body. There are also tiny pieces of cells in the blood called ..... These help to clot the blood if the skin is ..... If we could not make ..... we would be in danger of bleeding to death from even the smallest of cuts.

Task 2: Complete the table below

Blood vessel	Function	Adaptions
Artery		
Capillary		
Vein		

L2. The heart

A labelled diagram of the heart



The **natural resting heart rate** is **controlled** by a group of cells in the **right atrium (pacemaker)**. Artificial **electrical** pacemakers are used to **correct irregularities** in the heart rate.

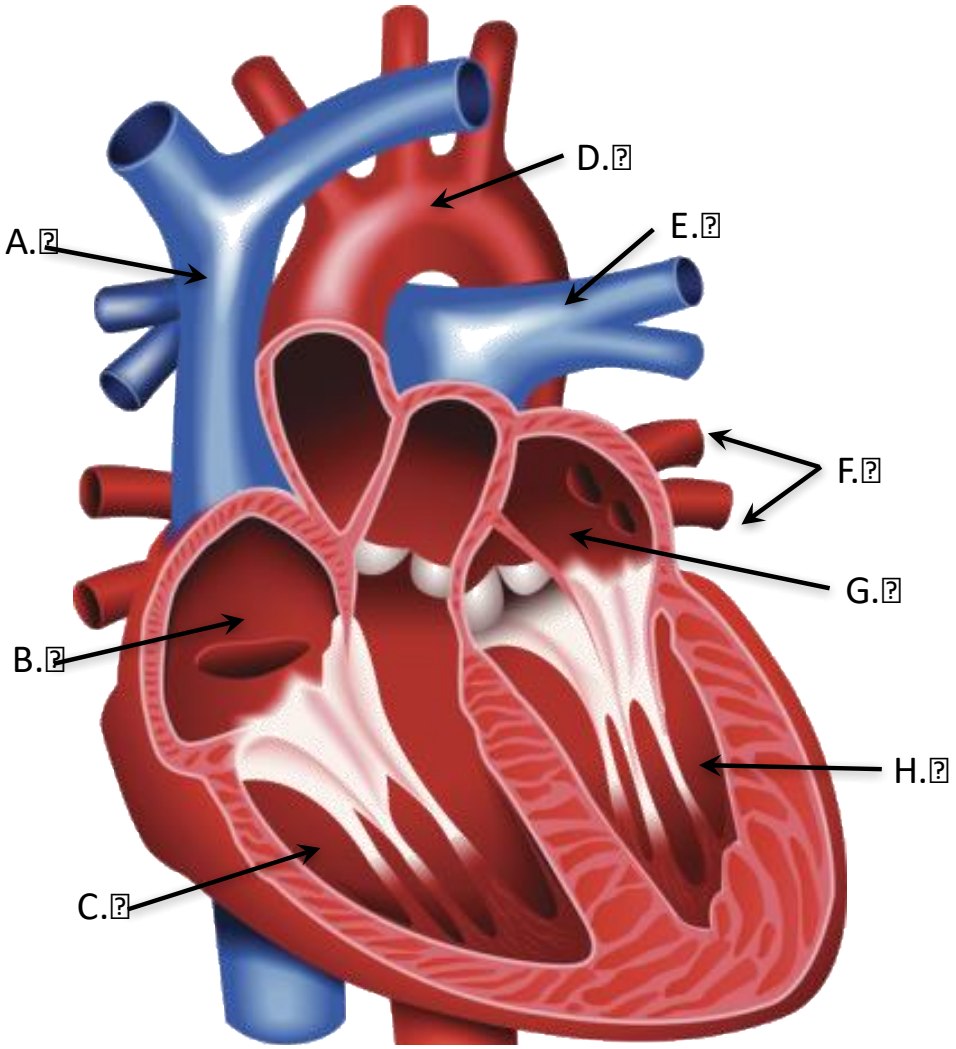
The heart is a **pump** that sends some blood to the lungs and some blood to the rest of the body each time it **beats**. The blood on the left side is kept **separate** from the blood on the right side. This is called **double circulation** and is a more efficient way of delivering oxygen to the tissues than single circulation.

Blood enters the heart through a vein and collects in an **atrium**. The atrium is emptied into a ventricle which **contracts** to put the blood under pressure. The blood is forced out through an artery as a **valve** prevents it flowing back to the atrium. The artery also contains a valve to stop blood flowing back to the ventricle when the ventricle relaxes

The left ventricle exerts more pressure than the right ventricle, and so it has a thicker more muscular wall. The atria (plural of atrium) exert less pressure than the ventricles so they have a thinner muscular wall.

L2. The heart activities

Task 1: Name the parts A-H from the diagram below



Task 2: Answer the following questions

a) What is a double circulatory system?

_____

_____

b) What is a pacemaker?

_____

_____

c) Where does the left atrium pump blood to?

_____

_____

L3. William Harvey

Blood circulation Knowledge of the circulatory system has developed over time.

Galen (2nd century)

Galen was a Roman doctor who gained knowledge through animal dissections. He understood the importance of the pulse and that blood moved around the body, but he made some mistakes. For example, he thought that the liver made blood for the veins and the heart made blood for the arteries

William Harvey (17th century)

William Harvey was a doctor in London. In his theory on the circulatory system, he explained that blood circulates from the heart to the lungs, and from the heart to the rest of the body. He was able to link the pulse in the arteries to the contractions of the left ventricle, and he realised that veins have valves to prevent the backflow of the blood.

A four-chambered heart

A single circulatory system (such as in fish) links to a two-chambered heart. One chamber receives blood from the body and the other pumps it back out.

However, a double circulatory system (such as in humans) links to a four-chambered heart. The right side is involved with moving *deoxygenated* blood to the lungs, and the left side is involved with moving *oxygenated* blood to the body.

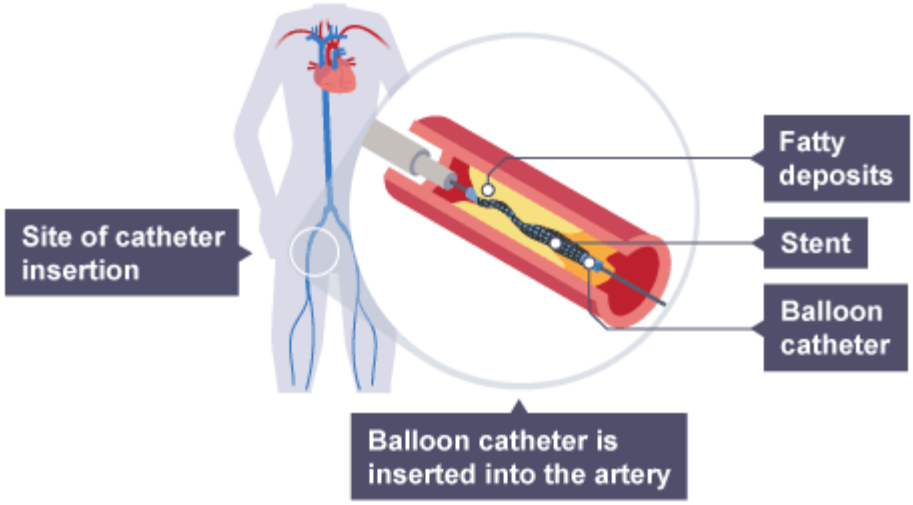
L4. Stents and statins

Stents

In order to keep beating, the heart muscle has its own artery called the **coronary artery**, which supplies the heart with *glucose* and oxygen. For patients who have heart disease, arteries can become narrower due to the build-up of fatty deposits within the wall of the artery. This has the effect of narrowing the *lumen* of the artery, reducing the amount of oxygenated blood that can be supplied to the heart muscle.

Stents are metal grids which can be inserted into an artery to maintain blood flow by keeping the artery open.

The stent then acts to keep the artery open so that the heart continues to receive enough oxygen to function effectively.



Stents are good alternatives to more risky operations, like *by-pass surgery*, providing the patient's heart disease is not too serious. However, fatty deposits may build up on the stent over time - meaning that blood flow to the heart muscle may be reduced again.

Statins

Statins are drugs which work to lower the level of cholesterol in the blood and stop the liver producing too much cholesterol and reduce the rate at which it is deposited. Statins can be taken if you have a heart attach or stoke to reduce this happening again. There are many different types of stations which a doctor can prescribe

L4. Stents and statins activity

Task 1: Complete the questions below

Q1. Drugs are used to treat cardiovascular diseases (diseases of the heart and blood vessels).

(a) What is a drug?

_____
_____ **(1)**

(b) People can be treated for cardiovascular diseases with statins or aspirin. Information about these two drugs is given in the table.

STATINS	ASPIRIN
Statins are only available on prescription from doctors.	Aspirin can be bought over the counter. Treatment with aspirin costs up to £15 per year.
In studies, 30 000 patients were monitored over several years. Statins were found to reduce the rate of non-fatal heart attacks by about 30%.	In a study of 1000 patients, aspirin was found to cause bleeding of the stomach in around 0.5% of patients and there was a slightly increased risk of poor blood clotting at cuts.
Approximately 0.1% of the patients suffered serious muscle damage and 0.01% suffered kidney failure.	There was a slightly increased risk of damage to the blood vessels in the brain in older patients.
Statins reduce blood cholesterol which builds up in the walls of blood vessels. The cost of treating patients with statins can vary between £150 and £500 per year, depending on the type of cardiovascular disease being treated.	Aspirin was found to reduce the risk of non-fatal heart attacks by 31%.

Would you recommend statins or aspirin for the treatment of cardiovascular diseases?

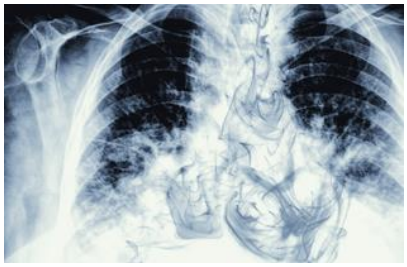
In your answer you should:

- give your recommendation
- use information from the table to support your recommendation by making comparisons of the two drugs.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____ **(5)**

L5. prevention of heart disease

There are many ways an individual can prevent the onset of heart disease, these include:



- Quitting smoking
- Healthy eating
- Staying active and many more

Smoking

Smokers are almost twice as likely to have a heart attack compared with people who have never smoked. Stopping smoking has huge benefits and it's never too late to give up.

Smoking increases the risk of developing cardiovascular diseases, which includes coronary heart disease and stroke.

Smoking damages the lining of your arteries, leading to a build up of fatty material (atheroma) which narrows the artery. This can cause angina, a heart attack or a stroke.

- The carbon monoxide in tobacco smoke reduces the amount of oxygen in your blood. This means your heart has to pump harder to supply the body with the oxygen it needs.
- The nicotine in cigarettes stimulates your body to produce adrenaline, which makes your heart beat faster and raises your blood pressure, making your heart work harder.
- Your blood is more likely to clot, which increases your risk of having a heart attack or stroke. Take a look at our cardiovascular disease page to find out more about blood clots and the damage they can do to your body.

Healthy eating

It can also help lower your cholesterol levels and reduce your risk of some cancers. Even if you already have a heart condition, a healthy diet can benefit your heart

Saturated fat

Too much saturated fat can increase the amount of cholesterol in the blood, which can increase the risk of developing coronary heart disease.

Unsaturated fats

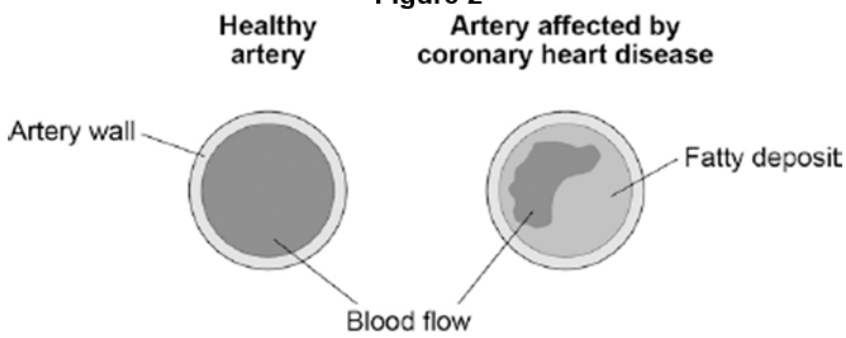
Unsaturated fats, which can be monounsaturated fats (for example olive oil, rapeseed oil, almonds, unsalted cashews and avocado) or polyunsaturated fats (including sunflower oil and vegetable oil, walnuts, sunflower seeds and oily fish) are a healthier choice.

L5. prevention of heart disease activity

Task 1: answer the questions below

(d) The coronary arteries supply blood to the heart.
Figure 2 shows two coronary arteries.

Figure 2



Describe **two** ways the healthy artery is different from the artery affected by coronary heart disease.

1. _____

_____

2. _____

_____ **(2)**

(e) What can be used to treat people with coronary heart disease?

Tick **two** boxes.

Antibiotics	☐
Hormones	☐
Statins	☐
Stent	☐
Vaccination	☐

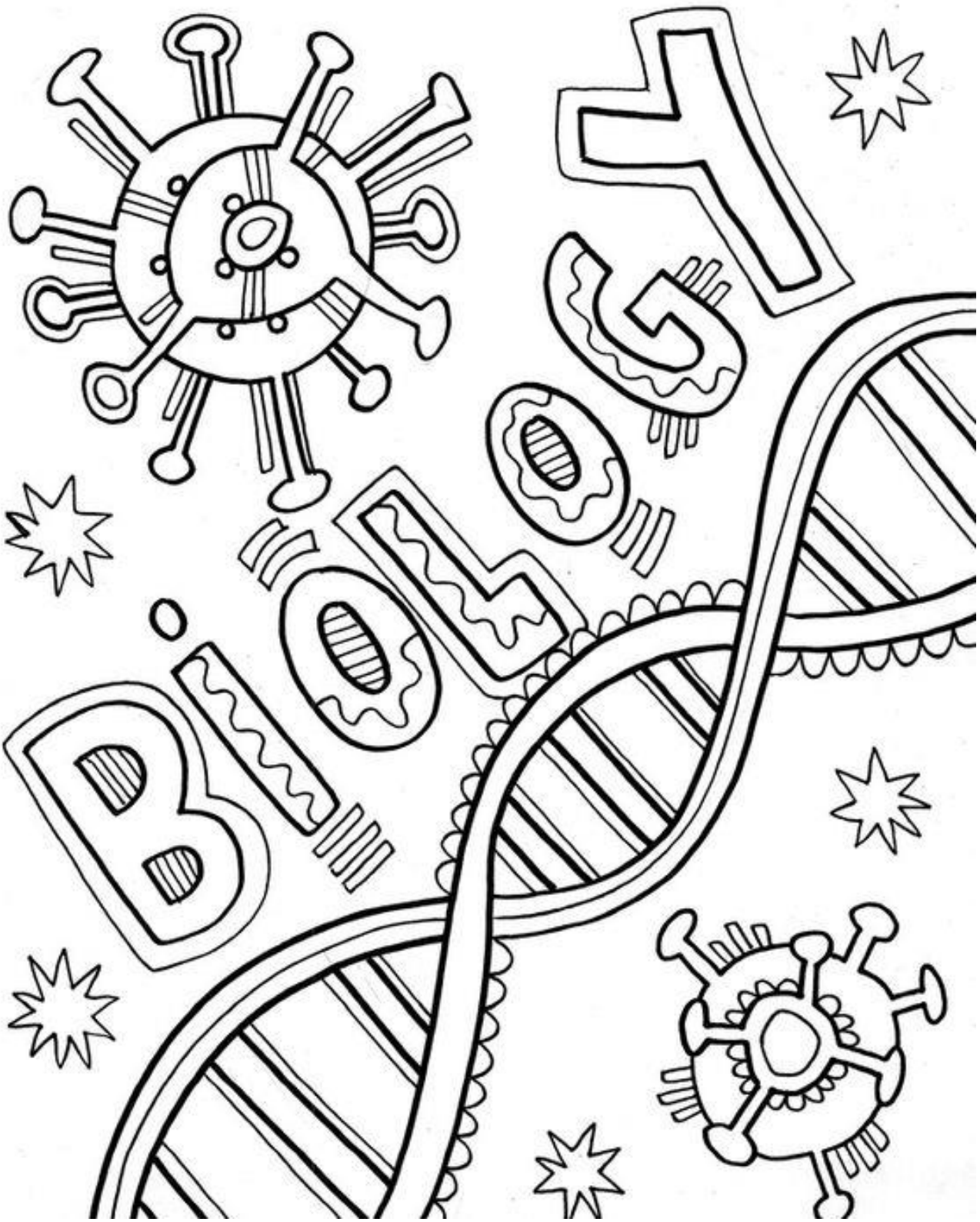
(f) Suggest **two** risk factors for coronary heart disease.

1. _____

_____

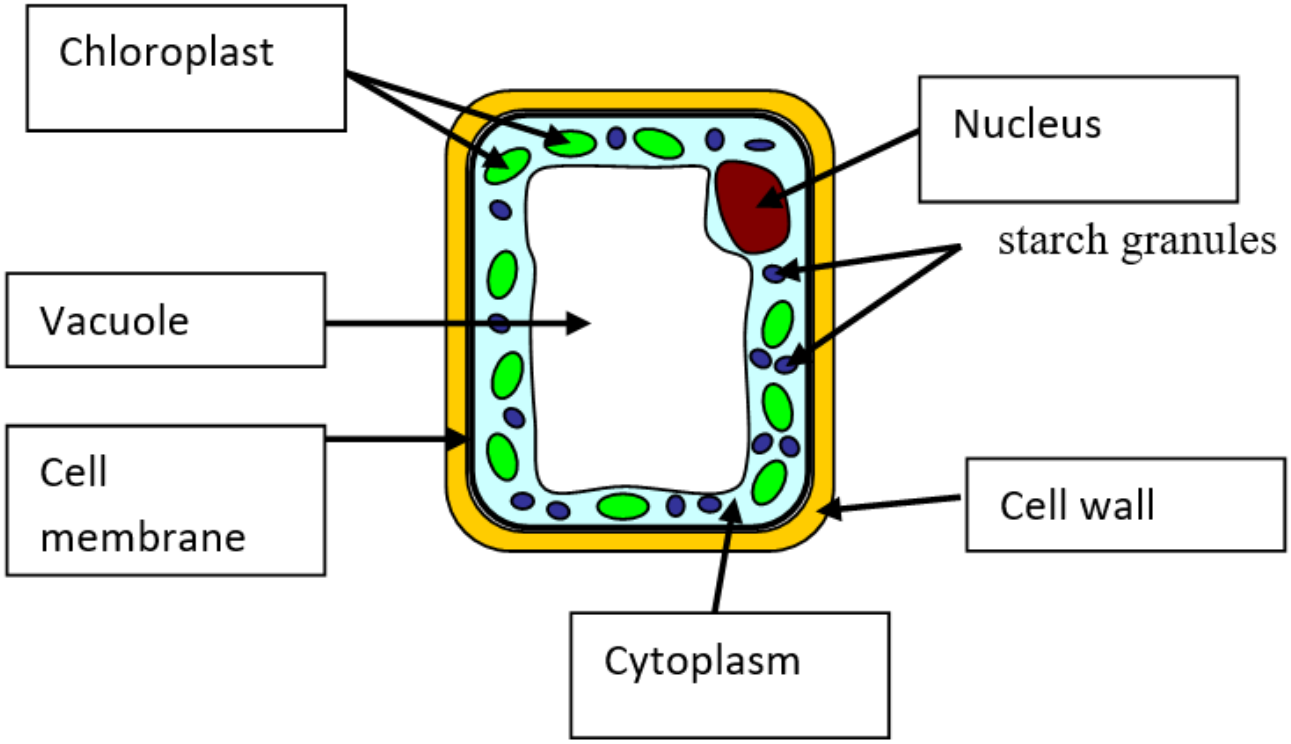
2. _____

_____ **(2**


BIOLOGY

L1. Photosynthesis answers

Task 1: Label the diagram of the plant cell below



Task 2: Write the chemical formula for the products and reactants of photosynthesis

Compound	Chemical formula
Oxygen	O_2
Carbon dioxide	CO_2
Water	H_2O
Glucose	$C_6H_{12}O_6$

Task 3: Match up the keyword to its definition

Photosynthesis 1	2 A green substance that absorbs light energy.
2 **Chlorophyll**	5 Energy is taken in from the surroundings.
Chloroplast 3	1 Endothermic reaction in chloroplasts that uses light energy to react carbon dioxide and water to produce glucose and oxygen
4 **Glucose**	3 Small organelle that contains chlorophyll.
Endothermic 5	4 A simple sugar made by plants and used in respiration.

L2. Leaf adaptations answers

Task 1: look – cover – write – check

Word/definition/information	1st try	2nd try
For example: Thin leaf - Allows sunlight to reach the palisade cells	*Thin leaf - Allows sunlight to reach the **palisade cells***	*Thin leaf - Allows sunlight to reach the palisade cells*
Contains lots of chlorophyll - Absorbs the sunlight needed for photosynthesis	Contains lots of chlorophyll - Absorbs the sunlight needed for photosynthesis	Contains lots of chlorophyll - Absorbs the sunlight needed for photosynthesis
Stomata - Allow carbon dioxide to move by diffusion into the leaf	Stomata - Allow carbon dioxide to move by diffusion into the leaf	Stomata - Allow carbon dioxide to move by diffusion into the leaf
Xylem and phloem - Xylem to transport water and phloem transports sugars (glucose)	Xylem and phloem - Xylem to transport water and phloem transports sugars (glucose)	Xylem and phloem - Xylem to transport water and phloem transports sugars (glucose)
Layer of palisade cells on the top - To absorb sunlight	Layer of palisade cells on the top - To absorb sunlight	Layer of palisade cells on the top - To absorb sunlight

L3. Factors limiting photosynthesis answers

Task 1: Answers

(b) increases **(1)**

levels off / reaches a maximum / remains constant / stays the same / plateaus

*do **not** allow stops / stationary / peaks*

allow stops increasing **(1)**

goes up to / reaches a maximum / levels off at (a rate of) 200 (arbitrary units)

or

levels off at 225 – 240 (light units)

ignore references to other numerical values **(1)**

(c) (i) higher light intensity does not increase rate of photosynthesis

accept the graph stays level (above this value)

allow stops increasing

allow the rate of photosynthesis stays the same (above this value) **(1)**

(ii) any **two** from:

- carbon dioxide (concentration)
- temperature / heat
- (amount of) chlorophyll / chloroplasts

allow water

allow ions / nutrients

ignore ref to surface area of the leaf **(2)**

Task 2: Answers are below

1) Photosynthesis is affected by limiting factors. What is meant by the term 'limiting factor'?

A factor which is not at an optimum level to enable maximum rate of photosynthesis e.g. temperature

2) Write down the word equation for photosynthesis

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

3) Name the green pigment present in plant cells.

Chlorophyll

4) What is the role of this green pigment?

To transfer energy from the environment and use it to synthesise glucose from carbon dioxide and water.

5) For the graph below - identify what the limiting factor(s) might be in the experiment.

Number of active sites on the enzymes up to point of enzymes being denatured

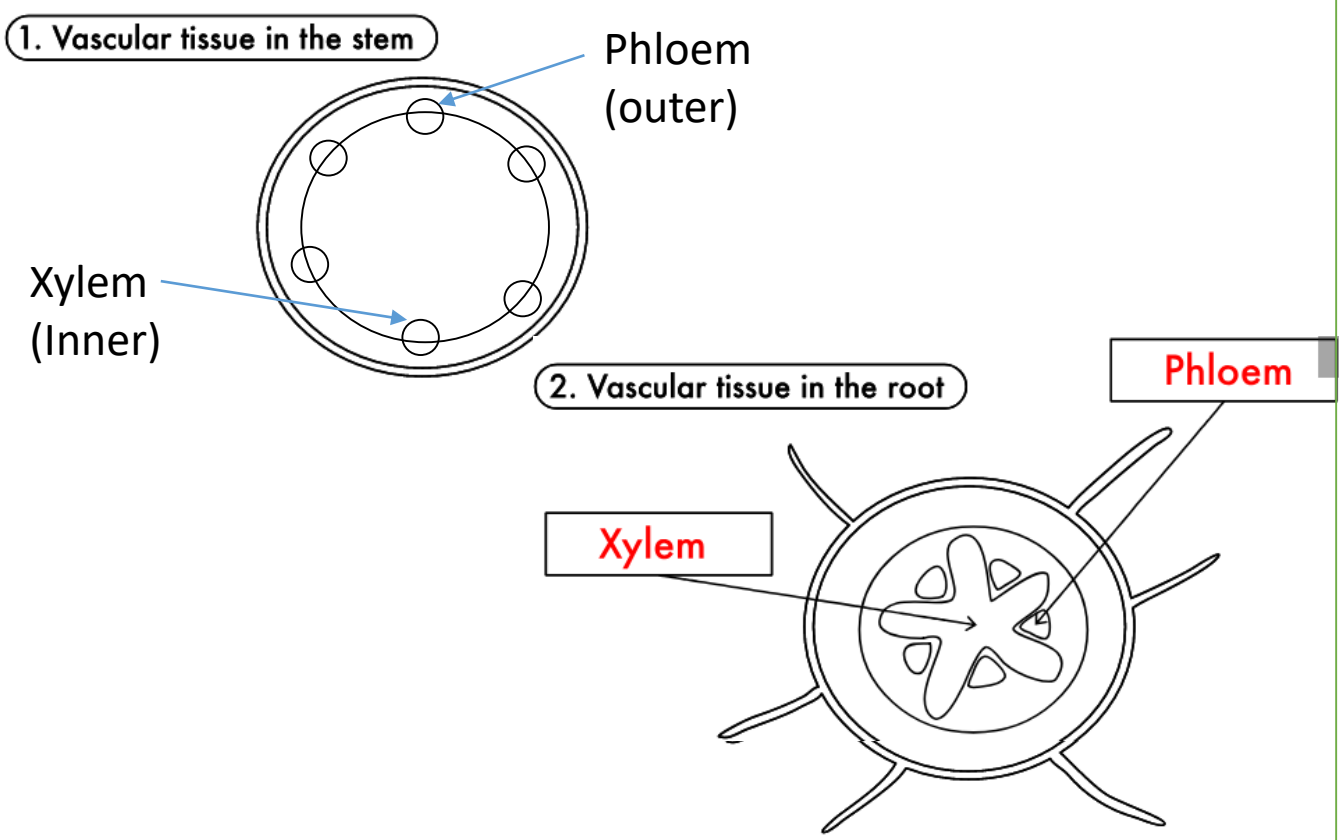
L4. Transport in plants answers

Task 1: Complete the paragraph below using the words given. All words are used only once

Word bank: downwards, water, amino, leaves, mineral, stems, long, leaves, vascular, up xylem, translocation, glucose, roots

Plants have a transport system in order to move substances relatively LONG distances from one location to another. The XYLEM tissue is responsible for moving WATER and dissolved MINERAL ions. Movement is always UP the plant, from the roots, through the stem and into the LEAVES. Phloem on the other hand transports dissolved GLUCOSE and AMINO acids in the plant. This process is known as TRANSLOCATION and movement in the phloem can be either upwards or DOWNWARDS. Xylem and phloem tissue are found in the ROOTS, LEAVES AND STEMS

Task 2: Complete the two diagrams below to show the arrangement of the xylem and the phloem in both the stem and the root of a plant



L5. Factors affecting transpiration answers

Task 1: Answers

Mark schemes

Q1.(a) 21.5 – 22 ***and*** 27 – 27.5

for 1 mark **1**

(b) *ideas of*
limiting factor / shortage of
e.g. light / carbon dioxide / water / chlorophyll

each for 1 mark
(allow 1 for 'maximum / optimum rate of enzyme activity if no reference to limiting factors) (ignore denaturation)
2

(c) 21.5 – 22° C

*(allow **first** figure from answer to (i) so that no 'double-penalty but only if this first answer is 20 or greater)*

maximum rate of photosynthesis / highest / fastest

but related to flat part of curve

most economical heating / cheapest related to heating

must relate to the temperature the candidate has given

each for 1 mark **3**

L1. Respiration answers

Task 1: the missing word for each sentence is present below

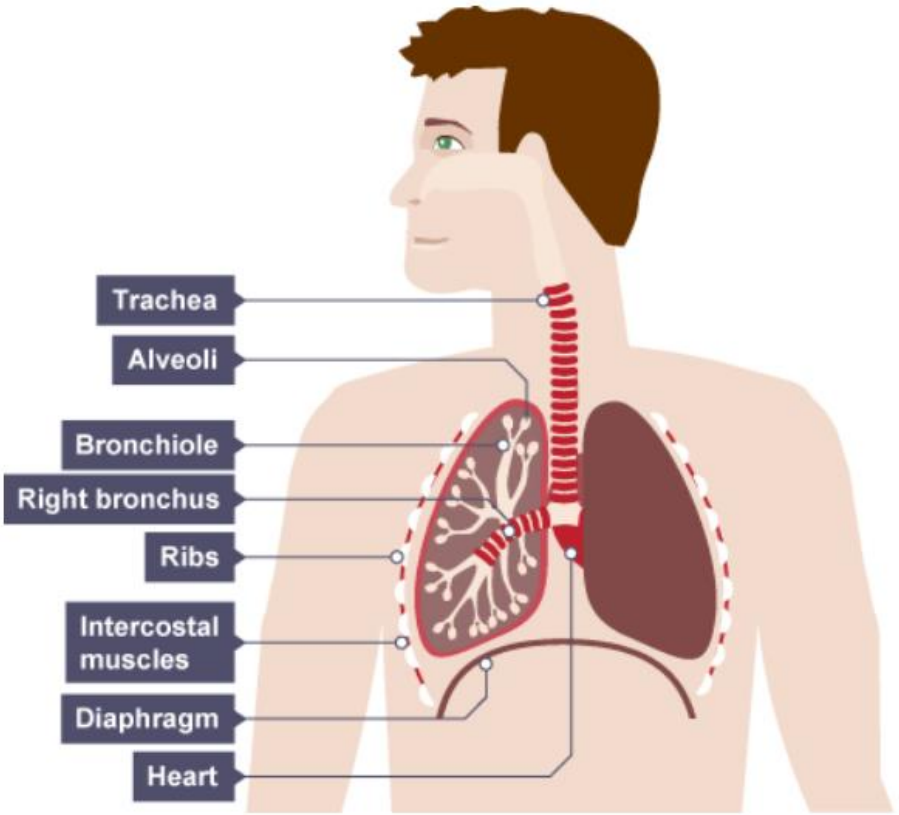
1) Energy **2) move**

3) Glucose **4) burning**

5) Carbon dioxide **6)breathing**

7) Oxygen

Task 2: the correct labels are present below



Structures in the respiratory system

L2. Aerobic and anaerobic respiration answers

Task 1: Complete the table below

	Aerobic	Anaerobic
Needs oxygen?	Yes	No
Needs glucose?	Yes	Yes
Product(s) formed	Carbon dioxide and water	Lactic acid

Task 2: Complete the passage using the following words, you can use the words more than once: Aerobic, Anaerobic, carbon, Energy, enough, glucose, poisonous, lactic acid, little, not all, not enough, oxygen, oxygen debt, pant, water

Organisms respire in order to release energy. **AEROBIC** respiration is respiration requiring **OXYGEN**. In aerobic respiration the reactants are **OXYGEN** and **GLUCOSE** The products are water and **CARBON** dioxide. **ENERGY** is also released.

Glucose + oxygen → carbon dioxide + water + **ENERGY**

ANAEROBIC respiration is respiration without oxygen. Anaerobic respiration takes place when there is **LITTLE** oxygen available but energy is required. This happens when an athlete runs very fast but the body cannot supply **ENOUGH** oxygen. In anaerobic respiration the reactant is only **GLUCOSE**. The product is **LACTIC ACID**

A **LITTLE** energy is released. This is because not all the energy is released from each glucose molecule.

Glucose → lactic acid + **energy**

Lactic acid is **POISONOUS**

To get rid of lactic acid the person will **PANT** in order to get a good supply of oxygen.
You have to keep breathing hard for a while after you stop to get oxygen into your muscles to convert the painful lactic acid which has built up to harmless **CARBON** dioxide. The amount of oxygen required to do this is called **OXYGEN DEBT**

L3. adaptation for gas exchange answers

Task 1: The missing words for each sentence are below

1. **Muscle**
2. **Inhale**
3. **Exhale**
4. **Contract**
5. **Volume**
6. **Decrease**
7. **Relax**
8. **increase**

Task 2: The answers are provided in order below

Oxygen, trachea, cartilage, bronchus, capillaries, blood

Task 3: Mark schemes

Q1.(a) (healthy alveolus has a) larger surface area

allow larger SA:Volume ratio

accept converse for alveoli from person with emphesema

*allow walls between alveoli disintegrate **or** fluid accumulation in alveoli*

1

Lesson 4/5 answers

Task 1: the missing words to each sentence are provided below

1) **Mucus**
2) **Hairs**
3) **Acid**
4) **Beating**
5) **Oxygen**
6) **cancer**

Task 2:Mark scheme

Q1.(a) person with muscle disease:

allow reverse argument for healthy person

any **three** from:

NB all points are comparative except peak (point 3)

*allow use of **two** approximate figures as a comparison*

- higher resting rate **or** higher at start
- when exercise starts / then increases more / more rapidly

accept description eg rise …. fall

- peaks (then falls)
- levels off later than healthy person
- higher rate during exercise

*if no other marks awarded allow **1** mark for 'it's higher'*

- greater range **3**

(b) (i) oxygen

accept adrenaline

accept O_2

*do **not** accept O, O2 or O^2* **1**

(ii) cannot release sugar / glucose (from glycogen)

or

cannot store glucose / sugar (as glycogen) **1**

need to receive glucose / sugar (from elsewhere)

ignore oxygen **1**

for energy / respiration / cannot store energy

ignore aerobic / anaerobic **1**

[7]

L1. Digestive system answers

Task 1: The answers are listed below clockwise from the top

Gullet, stomach, pancreas, small intestine, rectum, anus, appendix, large intestine, liver, gall bladder, salivary gland, tongue

Task 2: the answers are in the correct order below – starting from the top down

1) Mouth
2) Gullet
3) Stomach
4) Small intestine
5) Pancreas
6) Liver
7) Large intestine
8) Appendix
9) Rectum

L4. Digestive enzymes answers

Task 1: Cross out the wrong answers

- Fats and oils are essential to our **diet**
- They are used in the **production** of cell membranes, for storing energy and for heat insulation.
- Lipase is produced in the **pancreas**
- The stomach pH is too **acidic** for it to work.
- Bile is needed to make a **emulsion**.
- One product of fat digestion is **glycerol**
- Fatty acids & glycerol are easily **absorbed** into the blood stream

Task 2: Answer the questions below

Mark schemes

Q1.

(a) (i) stomach 1

(ii) small intestine 1

(b)

	salivary glands	stomach	pancreas	small intestine
amylase	✓	×	✓	✓
lipase	×	×	✓	✓
protease	×	✓	✓	✓

1 mark per correct row

or

if no correct row max 1 mark for any one correct column 2

		Organ producing enzyme			
		salivary glands	Stomach	pancreas	small intestine
Enzyme	amylase	✓	×	✓	✓
	lipase				
	protease				

L5. Digestive enzymes answers

Task: Mark schemes

Q1.

(a) (i) villus **1**

(ii) its outer surface is one cell thick

cancel 1 mark for each extra box ticked **1**

it has a large surface area **1**

it has good blood supply **1**

(b) diffusion **1**

L1. The blood answers

Task 1: the answers to the passage are provided in order.

Words bank: plasma, cut scabs, red, dissolved, germs, oxygen, platelets

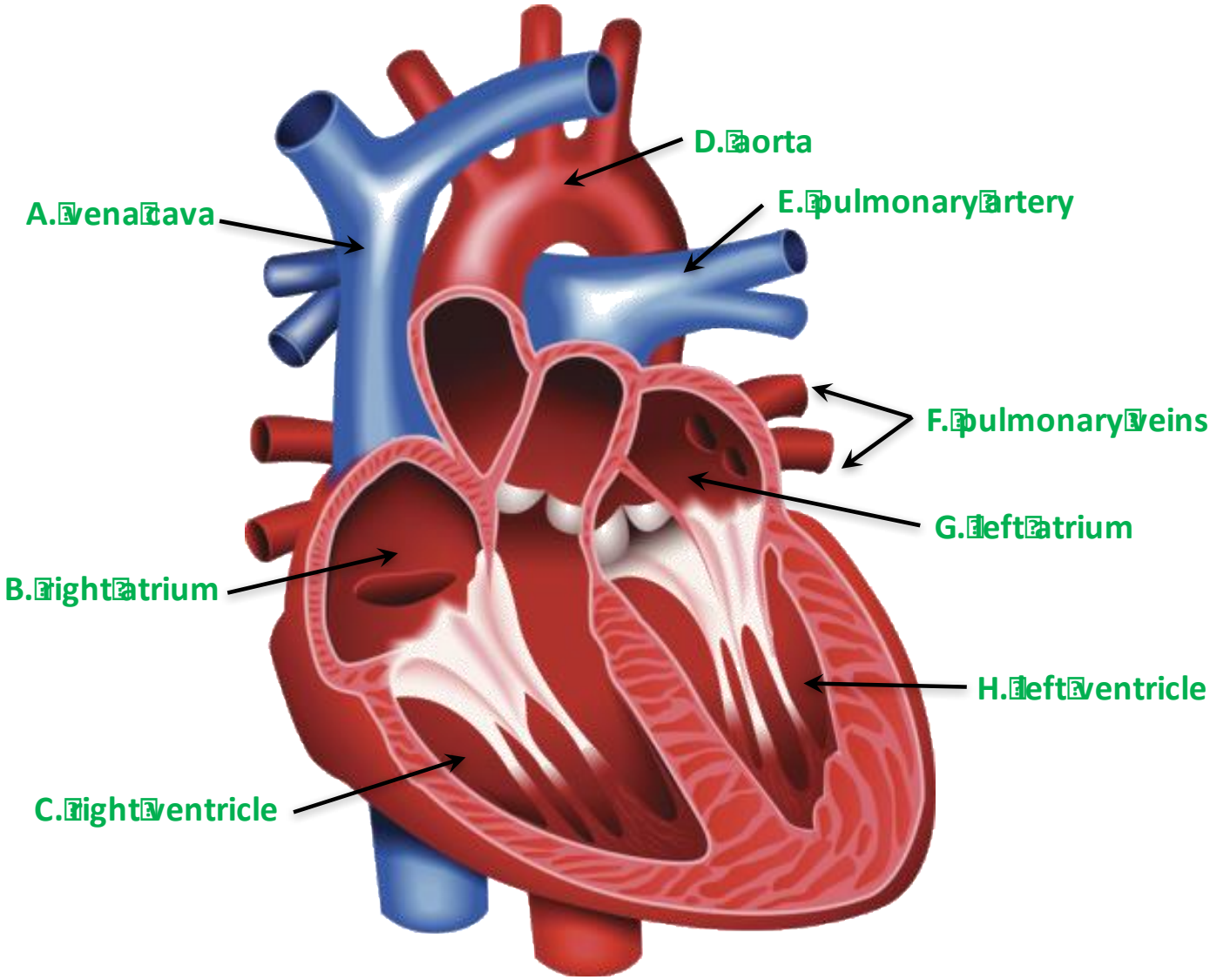
1) Plasma
2) Red
3) Dissolved
4) Oxygen
5) Germs
6) Platelets
7) Cut
8) Scabs

Task 2: Complete the table below

Blood vessel	Function	Adaptions
Artery	carry blood away from heart at high pressure	thick, elastic, muscular walls to withstand pressure and to exert force (pulse)
Capillary	allow exchange of materials between blood and tissues	thin permeable walls
Vein	return low pressure blood to heart	Large diameter to offer least flow resistance. Valves to prevent back flow.

L2. The heart answers

Task 1: Name the parts A-H from the diagram below



Task 2: Answer the following questions

a) What is a double circulatory system?

Where blood from the heart is pumped to the lungs and the body at the same time.

b) What is a pacemaker?

A group of cells in the right atrium that controls the heart rate.

c) Where does the left atrium pump blood to?

To the left ventricle.

L4. Stents and statins answers

Task 1: Mark schemes

Q1.

(a) (substance / chemical) that affects body chemistry / chemical reactions in the body

1

(b) statin / aspirin / neither recommended

no mark, may be implied. If no recommendation or implication, max 4 marks

answers should be comparative

any **five** from:

- argued evaluation in favour of aspirin or statin or neither

answers could include reference to

*accept converse for statins / aspirin but **not** as advantage of one **and** disadvantage of other*

for statins:

- more people in studies
- so data / findings more repeatable

accept reliable for repeatable

ignore accurate / precise

- reduces cholesterol but aspirin doesn't

allow reduces cholesterol but no evidence about aspirin

- aspirin (may) causes bleeding / poor clotting but statins do not

allow aspirin causes bleeding / poor clotting but no evidence about statins

- smaller (total) percentage suffer side-effects
- monitored by doctor, aspirins not

for aspirin:

- cheaper
- can be bought over the counter rather than prescribed
- statins cause serious damage / muscle damage / kidney failure but aspirins do not

similarities:

- both have similar effect on reducing (non-fatal) heart attacks
- incidence of side-effects low in both

allow (for aspirin) higher reduction of risk of heart attack

5

L5. prevention of heart answers

Task 1: Mark scheme

(d) no fatty deposit **1**

healthy artery is wider / bigger hole / has more blood flow **1**

(e) statins **1**

Stent **1**

(f) any **two** from:

- smoking
- high-fat diet
- lack of exercise

allow:

- *overweight / obese*
- *having high blood pressure*
- *having high cholesterol* **2**