ARCHBISHOP ILSLEY CATHOLIC SCHOOL

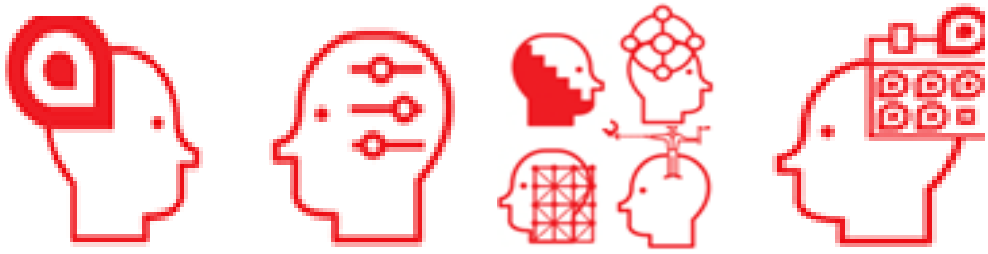
Justus et Tenax Propositi - Just and Firm of Purpose

AQA GCSE Combined/Triple Science

Biology

B2 Organisation

Knowledge and Mastery Book



Do not write in this booklet

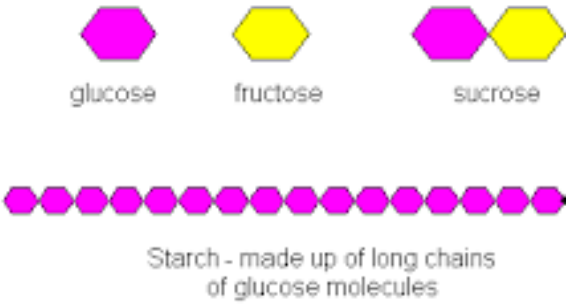
ALL answers to be written in your exercise book

Contents

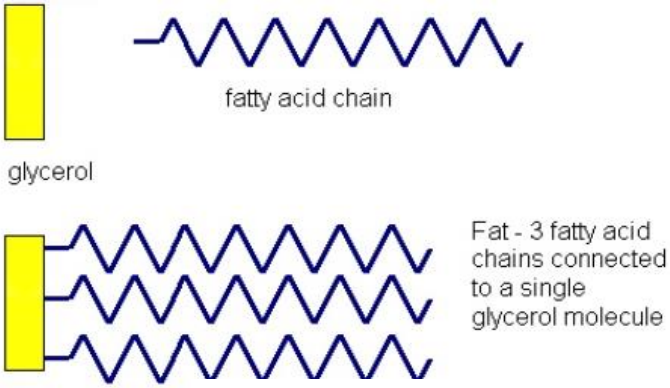
Lesson 1: Food Tests

Carbohydrates, lipids and protein make up most parts of a cell. Therefore, it is important we have lots of them. This makes them the main parts of our diet.

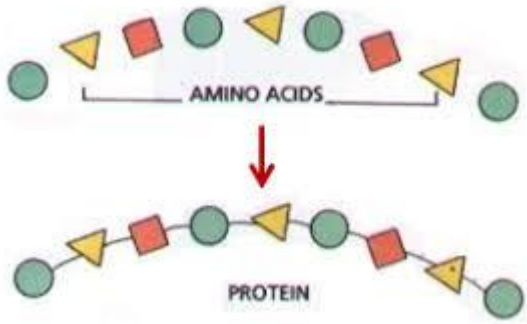
Carbohydrates help provide us with energy. All carbohydrates contain carbon, oxygen and hydrogen. Glucose ($C_6H_{12}O_6$) is a simple carbohydrate made of a single carbohydrate molecule. Sucrose is also a simple carbohydrate made up of two carbohydrate molecules joined together. Glucose molecules can be combined in long chains to form complex carbohydrates. Examples of this include starch and glucagon which act as energy storage molecules in plants and animals respectively. Carbohydrate rich foods include bread, pasta and potatoes.



Lipids are fats and oils. They are an energy store in our cells. When combined with other molecules they can be used to make cell membranes. Like carbohydrates they are made up of carbon, hydrogen and oxygen. They are insoluble in water. Each lipid molecule is made up of three molecules of fatty acids combined with a molecule of glycerol. Olive oil, vegetable oil, cheese, butter and margarine are all sources of lipids.

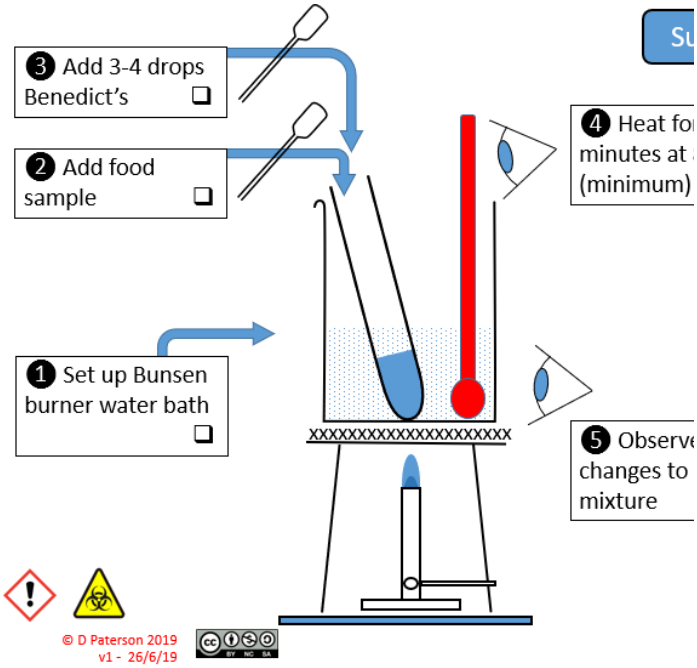


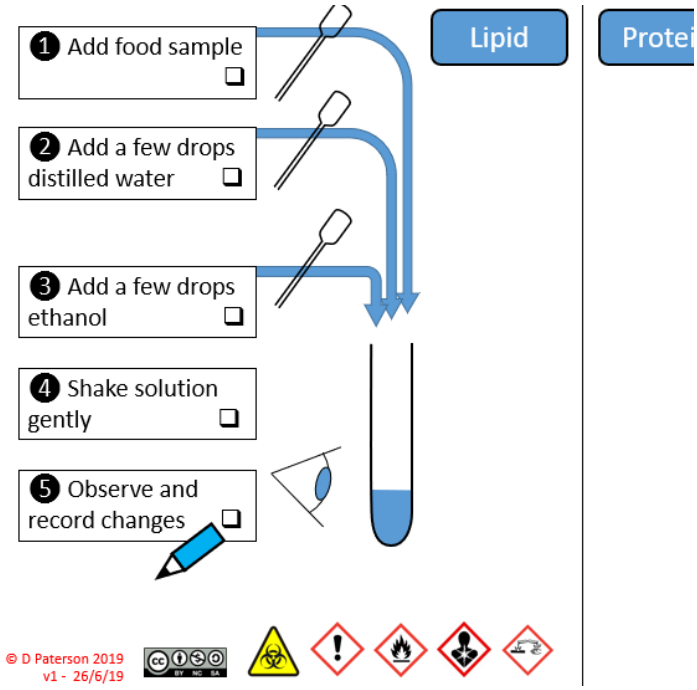
Proteins are polymers made up of amino acids joined together. There are twenty different amino acids which can be combined in different orders to make new proteins. Proteins are used to build our cells and our enzymes. Protein is made up of carbon, hydrogen, oxygen and nitrogen. Protein rich foods include meat, fish and cheese.



Nutrient	Made of	Uses in living organisms	Sources in our diet
Carbohydrate	Carbon, hydrogen and oxygen		
Lipids (Fats)		Energy store, part of cell membrane	
Protein			Meat, fish, diary

Testing foods required practical





Lesson 1 Mastery Questions

1. What is an enzyme?
2. What does the term 'denature' mean?
3. Breifly explain the 'Lock & key' mechanism
4. What are lipids broken down by, and what are the products?
5. What tests for sugar, and what would the colour change be?
6. What does iodine test for, and what is the colour change?
7. Where is bile produced?
8. Give two functions of carbohydrates.
9. State the monomer (the basic unit) of carbohydrates.
10. Glucose is absorbed by the small intestine no matter how low its concentration in the digested food. Which transport process is used?
11. State the chemical formula of glucose.
12. What process causes water to move across the cell membrane from a dilute solution to a concentrated one?
13. Give two functions of proteins.
14. Which atoms make up proteins?
15. What makes up proteins?
16. Describe how different proteins can be made from the same 3 amino acids
17. If a protein shake is 250g in total advertises it is 40% protein how much protein is in the shake?
18. Give two examples of complex carbohydrates.
19. What types of food contain lots of carbohydrates? Give three examples.
20. What are the two types of lipids?
21. Which elements make up lipids?
22. State two functions of lipids.
23. What is the function of the cell membrane?
24. What types of food contain lots of lipids? Give two examples.
25. What does iodine test for?
26. What does Benedict's test for?
27. What does Biuret test for?
28. What does Sudan III Test for?

Tests for…	Reagent	Method	Start Colour	End Colour
Proteins				
Fats				
Sugars				
Starch				

Lesson 1 Exam Questions

Q1.

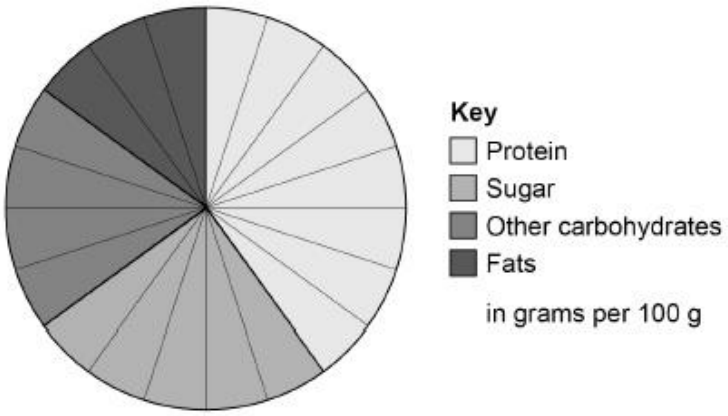
An athlete decides to try a new type of protein drink after he exercises.

(a) The athlete tests the protein drink to check it contains protein.
Write down which solution is used to test for protein in the drink **(1)**
Benedict's Biuret Iodine Universal Indicator

(b) Write down what colour will the solution turn to if there is protein in the drink? **(1)**
Blue-Black Purple Red Yellow

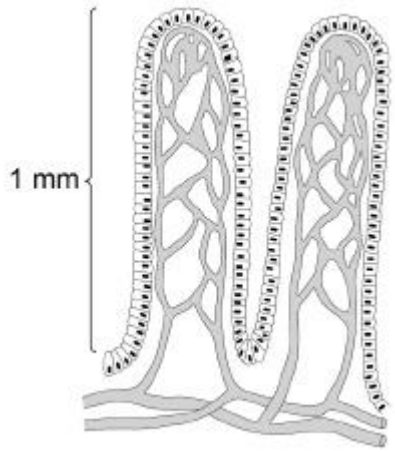
Figure 1 shows the proportion of different nutrients in the protein drink.

Figure 1



(c) State the ratio of sugar to protein in the protein drink? **(1)**
(d) What does the body use protein for? **(1)**

When the athlete drinks the protein drink the substances are digested.
The products of digestion are absorbed into the bloodstream.
Absorption happens in the small intestine.
The picture to the right shows a section of the small intestine.

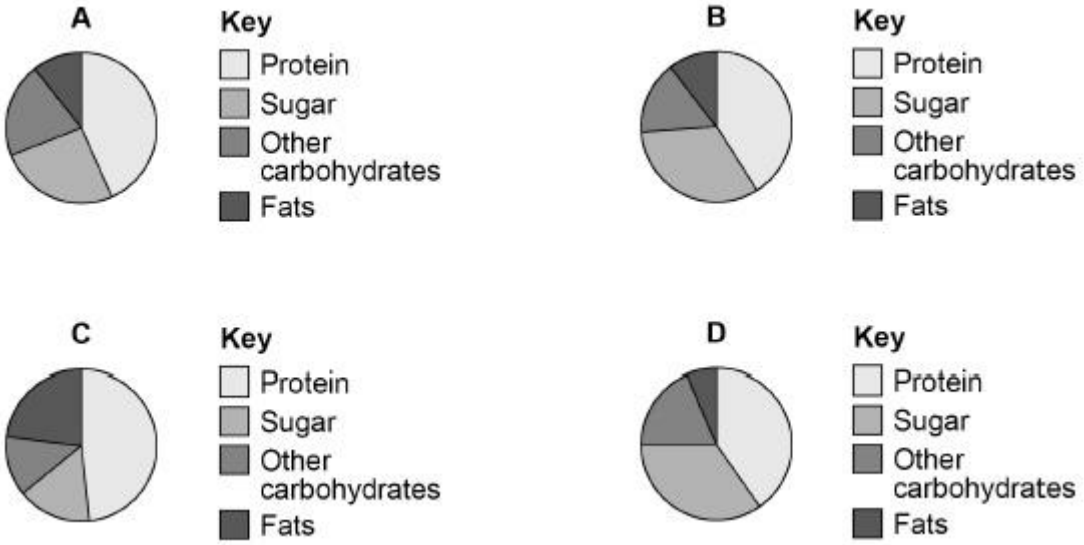


(e) Write down which two of the following options describe how the intestine in **Figure 2** is adapted to absorb the products of digestion quickly:

Large surface area
Long diffusion pathway
Thin surface
Concentration inside the small intestine is low
Poor blood supply

(f) **Figure 3** shows the proportion of different nutrients in four protein drinks.

Figure 3



Write down which drink someone with diabetes should consume, and suggest a reason why. **(2)**

Lesson 2: Organisation & The Digestive System

Tissues and Organs

Cells are the building blocks of life. In the previous topic we learnt how prokaryotic cells differ from eukaryotic cells. Eukaryotic cells are more complex and can form multicellular life forms, like humans, daisies, mushrooms and grasshoppers. To form a multicellular life, cells need to differentiate into specialised cells. This allows groups of cells joined together that perform the same function. A group of specialised cells that work together to do the same job is called a **tissue**. Examples of tissues include muscle tissue (which contracts), epithelial tissue (which covers the outside of the body or around organs) and glandular tissue (which secrete mucus, enzymes or hormones).

When more than one tissue is working together to complete a specific function, an **organ** is formed. An example of an organ is the stomach. The stomach is made up of muscular tissue, glandular tissue and epithelial tissue. Other examples of organs include heart, brain, skin, pancreas, and kidney. The pancreas has two important functions creating the hormones that control blood glucose concentration and producing enzymes used in digestion.

A whole multicellular organism is made up of a range of **organ systems**. These organ systems are made up of many organs. An example of an organ system is the digestive system and it is made up of organs such as the mouth, stomach, small intestine and large intestine to name a few. Other examples of organ systems include reproductive system, circulatory system and respiratory system.

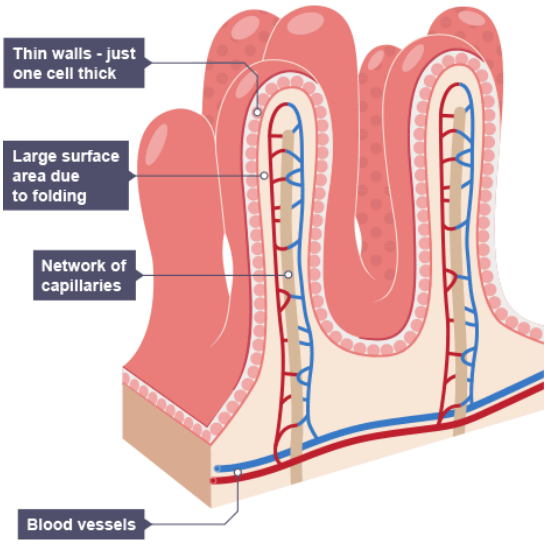
The Digestive System

Your digestive system is up to 9m long. The digestive system is an organ system made of many organs that carry out **digestion**. Digestion is the breakdown of large food molecules into smaller ones. This is important because these large molecules are too big to be absorbed into our blood at the small intestine. These organs include:

- the salivary gland and pancreas (that produce **enzymes**),
- the liver (that produces bile which emulsifies fat – turns fat into tiny droplets),
- the stomach (that produces certain enzymes and hydrochloric acid),
- The small intestine (a muscular tube that can contract to move food along it. It also produces and secretes enzymes).
- The large intestine (that absorbs and contains bacteria to break down any undigested food)
- The inside walls of the small intestine are covered in folds these folds are covered in finger-like projections known as **villi** the folds and finger-like villi **increase** the surface area inside the small intestine. On the villi are also micro-villi which also increase surface area. Like all exchange surface the small intestine has some common adaptations such as:

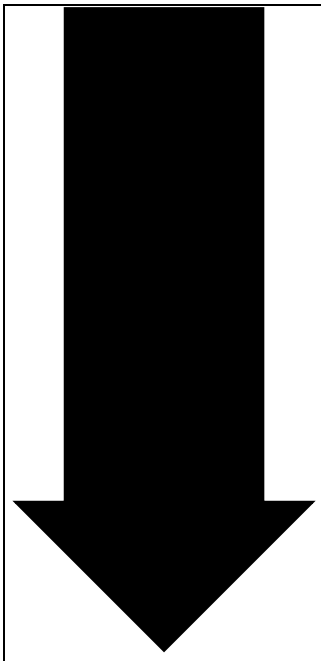
- A good blood supply to maintain a steep concentration gradient.
- Thin wall/membranes to provide a short diffusion distance
- Lots of villi and microvilli to increase surface area.

All these adaptations speed up the diffusion of digested food. Additionally, cells in the small intestine may have lots of mitochondria to carry out respiration to release energy that is used for active transport of glucose.



Lesson 2: Mastery Questions

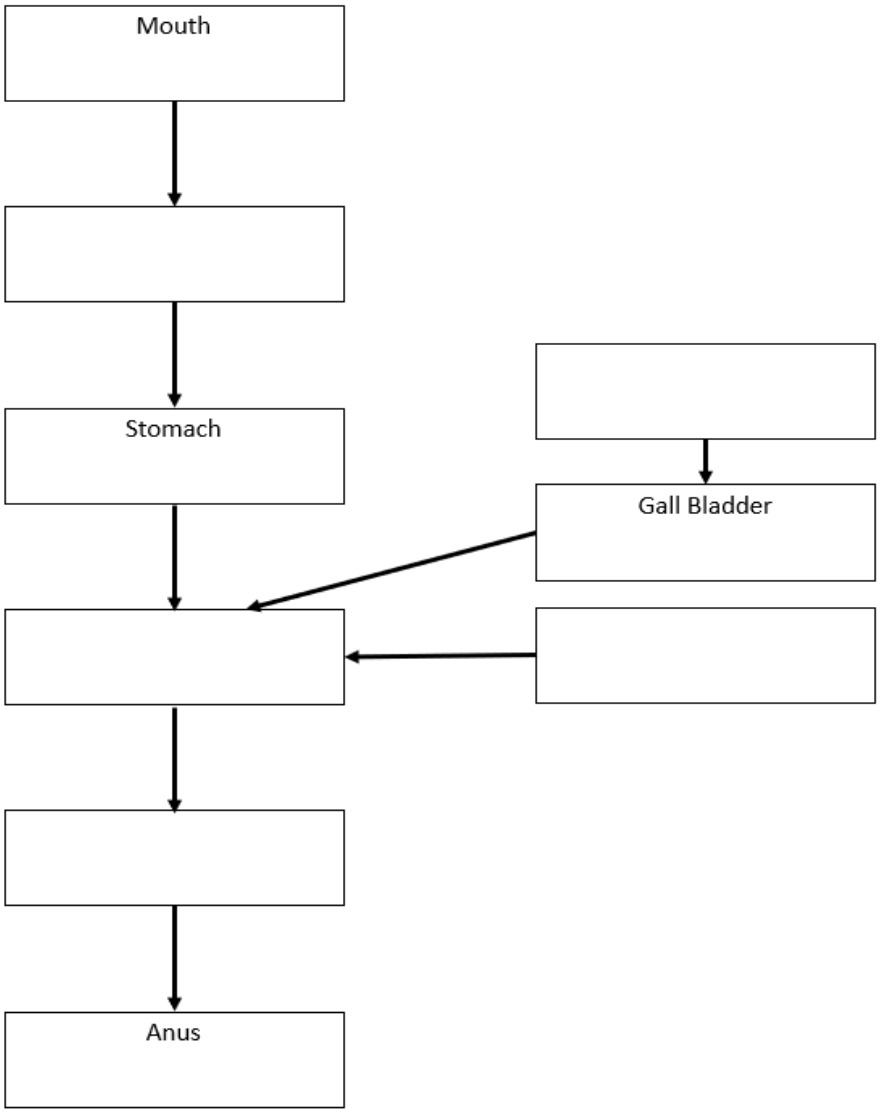
1. Define a Cell
2. Define a Tissue
3. Define an Organ
4. Define an Organ System
5. Complete the table (one row has been completed for you)



Organisational levels	Definition	Example
Cell		
Tissue	A group of specialised cells the perform the same function	Muscle
		Digestive system
Organism	A living thing made up of cells	Human

6. Define 'tissue'.
7. Define 'organ'.
8. List the organisation levels from the simplest to more complex
9. List 4 organs
10. What is the difference between an organ an organ system?
11. What is the specialised cell that forms muscle tissue?
12. True or false: Prokaryotic cells can form multicellular life
13. The stomach contains mainly three types of tissues. State their functions.
    a.) Muscular tissue
    b.) Glandular tissue
    c.) Epithelia tissue
14. What is digestion?
15. Why is digestion important to us?
16. Explain why the digestive system is an organ system.
17. List all the organs that secrete enzymes.
18. What is the name of the muscular tube which absorbs nutrients?
19. Why do the intestines have villi?
20. What three adaptations do the villi have which help speed up the diffusion of nutrients into the blood?

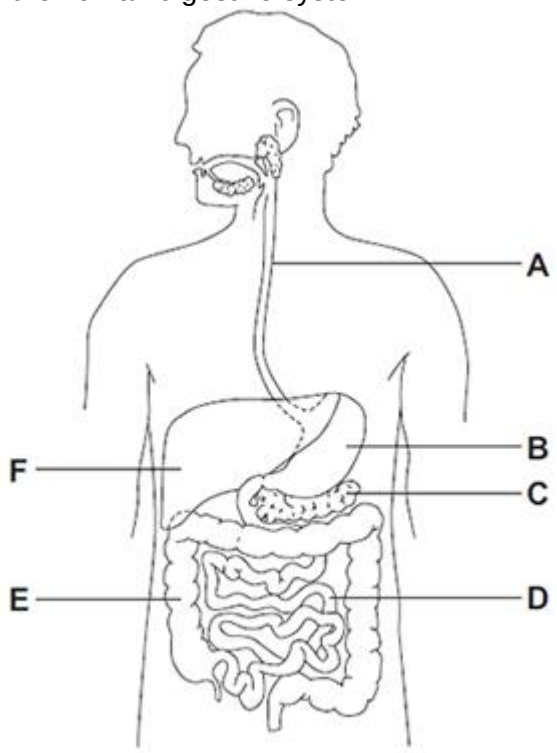
21. Summarise the information on the previous page in the flow chart below



Lesson 2 Exam Questions

Q1.

The digestive system breaks down food into small molecules.
The small molecules can be absorbed into the blood.
The diagram below shows the human digestive system.



(a) (i) Which letter, **A**, **B**, **C**, **D**, **E** or **F**, shows each of the following organs?
Write down which letter shows the following organs:

Large Intestine
Small Intestine
Stomach

(3)

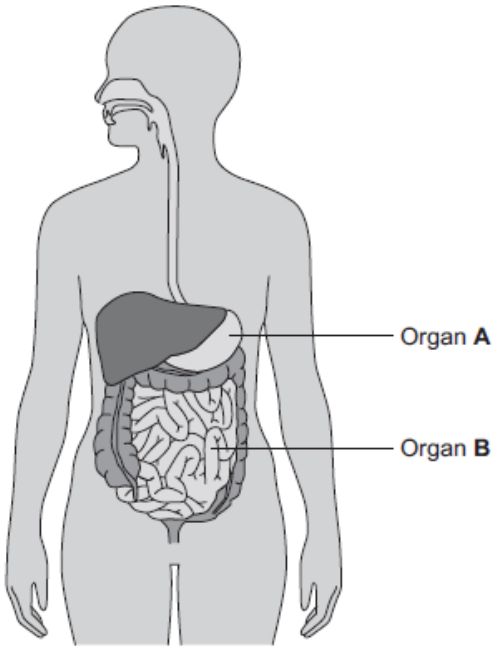
(ii) Different organs in the digestive system have different functions.
Write down which function matches which organ

Function	Organ
Digestion of fat	Large intestine
Absorption of water into the blood	Liver
Production of hydrochloric acid	Small intestine
	Stomach

(3)
(Total 6 marks)

Q2.

The diagram below shows the human digestive system.



(a) (i) What is Organ **A**?
Write the correct answer.

gall bladder **liver** **stomach**

(1)

(ii) What is Organ **B**?
Write the correct answer.

large intestine **pancreas** **small intestine**

(1)

(b) Digestive enzymes are made by different organs in the digestive system.
Copy and 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)

(c) The stomach also makes hydrochloric acid.
Write in your books how does the acid help digestion?

(1)

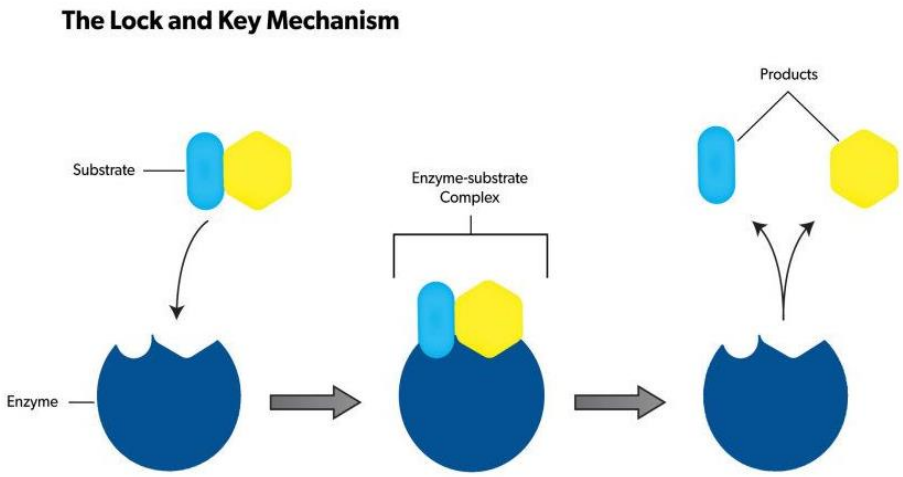
(d) Write the digestive enzyme in your books with the appropriate breakdown product

Digestive enzyme	**Breakdown products**
Amylase breaks down starch into……	**amino acids.**
Lipase breaks down fats into…	**bases.**
Protease breaks down proteins into…	**fatty acids and glycerol.**
	sugars.

(3)

Lesson 3 Introduction to Enzymes

Enzymes are proteins. They are incredibly useful and play a role in every process that keep organisms alive. Enzymes are biological catalysts. A catalyst is a substance that speeds up a chemical reaction but is not used up. They do this by reducing the activation energy of a reaction- that is the energy needed for a reaction to take place.



Enzymes can catalyse reactions that break large substances down into smaller ones or build large ones from smaller molecules. Enzyme are incredibly good at doing one specific function. An enzyme is able to bind to only specific molecules (known as the **substrate**). They have an area called the **active site** when the **substrate(s)** bind. This has a very specific shape. A model people use to explain this is the idea of a lock and key. The enzyme is the 'lock' and the substrate is the 'key'. The main role of enzymes in the digestive system is in the breakdown of large insoluble molecules into smaller soluble ones.

The main enzymes in our digestive system are **carbohydrases** (amylase), **proteases** and **lipases**.

Carbohydrases digest carbohydrates. Amylase is the carbohydrase which breaks down starch. Amylase is produced in the salivary glands, pancrease and small intestine. Amylase carries out its function in the mouth and small intestine. Protease digests protein into amino acids. Protease is produced in the small intestine, stomach and pancreas. Protease is used in the stomach and small intestine. Lipases digest lipids (fats and oils) into three fatty acids and glycerol. Lipase is made in the small intestine and pancreas but is only used in the small intestine. Fats are insoluble in water, so bile is added from the liver to emulsify the fats. This breaks them into small droplets, increasing the surface area so the lipase can work efficiently.

Lesson 3 Mastery Questions

1. Use the information above to complete the table.

Enzyme	Substrate	Products	Made in	Works in
Protease	Protein	Amino acids	Small intestine Stomach Pancreas	Stomach Small intestine

2. Copy and complete the following:
    a. A catalyst is…
    b. An enzyme is…
    c. An enzyme-substrate complex is…
    d. Activation energy is…
    e. An active site is…
3. What are enzymes?
4. What is the active site of an enzyme?
5. Name the types of enzymes that catalyse the breakdown of:
   a.) Carbohydrates
   b.) Lipids
   c.) Proteins
6. Which organs in the digestive system produce digestive enzymes?
7. Use the lock and key diagram to explain why lipase will not work on a substrate of starch.
8. Catalase is an enzyme that speeds up the breakdown of hydrogen peroxide. The enzyme increases the rate of reaction, so it is 700 times faster. If the enzyme reaction took 1.9s how long would the reaction take if there was no enzyme? Convert the answer to minutes. Give your answer to 4sf.
9. What is an enzyme?
10. What is a catalyst?
11. What are the four factors affecting enzyme activity?
12. What is the lock and key mechanism?
13. How does temperature affect enzyme activity?

Lesson 3 Exam Questions

Q1.

Proteins are broken down by protease enzymes.

(a) Which organs in the digestive system produce protease enzymes?
Mouth Liver Pancreas Stomach

(1)

A student used a colorimeter to investigate the rate of protein digestion of an insoluble protein.

A colorimeter measures the percentage of light that passes through a liquid.

The student measured the percentage of light passing through different concentrations of protein suspension.

The student used the results to produce a concentration curve.

The table shows the results.

Concentration of protein in g/dm^3	**Percentage of light passing through the suspension**
0.0	100
0.5	93
2.0	75
10.0	38

(b) Plot the data from the table in your exercise books.

(3)

(c) Explain the change in the percentage of light passing through the suspension.

(2)

(d) Suggest how the student could improve their investigation to draw a more accurate concentration curve.

(1)

The student then investigated the rate of protein digestion with protease obtained from two different organs.
This is the method used.

1. Put 5 cm^3 of protease from each organ into separate test tubes.
2. Put 10 cm^3 of protein suspension into two other test tubes.
3. Put all four tubes into a water bath at 37 °C for 10 minutes.
4. Mix each 5 cm^3 of protease into a tube of protein suspension.
5. Take a sample of each mixture every 2 minutes.
6. Measure the percentage of light passing through each sample using a colorimeter.

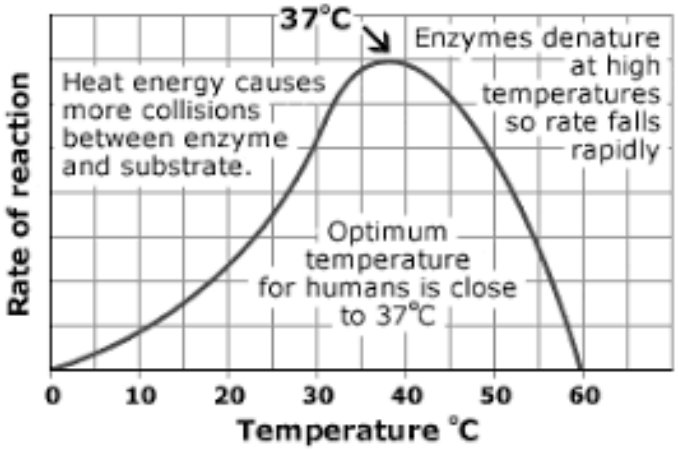
(e) Suggest why the protease and the protein suspension were put into a water bath before being mixed.

(1)

Lesson 4-5: Effect of pH or Temperature on Amylase Activity

Biological reactions are affected by the same factors as any other chemical reaction: concentration, temperature, and surface area. We are going to focus on the effect of two variables on enzyme-controlled reactions: temperature and pH.

An increase in temperature will increase the rate of an enzyme-controlled reaction up to a certain amount. After about 41^{O}C the enzymes will start to become **denatured**. When an enzyme is denatured it loses its **shape**, the active site can no longer bind to the substrate and no enzyme-substrate complexes are formed. When temperature is too low the reaction is slow because the enzymes don't have much **kinetic energy** and so rarely collide with their substrate

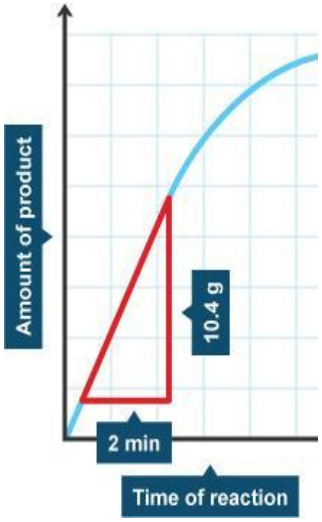


The graph to the right shows how enzymes in the human body are affected by temperature. But some **extremophiles** (organisms that live in extreme environments) have enzymes that work at temperatures up to 80^{O}C.

Each enzyme has an optimum pH, outside of this pH the enzyme becomes less effective and eventually can be denatured. This is because the active site can change shape, preventing the formation of enzyme-substrate complexes.

Glands in the stomach release a protease known as pepsin. This pepsin is adapted to work at low pH (acidic). The stomach also produces hydrochloric acid to ensure that pepsin can work most effectively. The stomach produces a thick layer of mucus which coats your stomach and prevents the hydrochloric acid from digesting the walls of the stomach. After being digested in the stomach, food moves into the small intestine. The enzymes in the small intestine, such as pancreatic amylase, prefer an alkaline environment. To produce an alkaline environment **bile** is produced in the liver. Bile is stored in the gall bladder and is then released into the small intestine to neutralise the acidic solution coming from the stomach. Bile has another job. It emulsifies the fats in our food. This increases the surface area of the fat molecules and allows lipase to break down fats faster.

Lesson 4-5 Mastery Questions



1. What does *denatured* mean?
2. What happens to enzymes when the temperature is: a.) Too low b.) Too high
3. Explain the effects of temperature on enzyme action.
4. What does the word *optimum* mean?
5. What is the optimum temperature for enzymes in the human body?
6. How does a change in pH cause enzymes to denature?
7. Using the graph given, calculate the rate of reaction of the enzyme. Remember to include units.
8. What is pepsin?
9. Where is bile produced?
10. State where bile is stored?
11. What are two differences between pepsin and pancreatic amylase?
12. What is the difference between pepsin and proteases produced by the pancreas?
13. What are the functions of hydrochloric acid in the stomach?
14. How is the stomach adapted to protect itself from pepsin and the hydrochloric acid?
15. Suggest the optimum pH for enzymes to work in the small intestine.
16. Suggest the optimum pH for enzymes to work in the stomach
17. What happens to an enzyme outside its preferred pH?
18. What else can cause enzymes to be denatured?
19. Which organ produces bile?
20. Describe and explain the functions of bile.
21. Why is emulsification important to lipid digestion?
22. Enzymes are made and used in all living organisms.

(a) What is an enzyme?
(b) Many enzymes work inside cells. In which part of a cell will most enzymes work?
(c) We can also use enzymes in industry.

Hydrogen peroxide is a chemical that can be used to preserve milk.
Adding a small amount of hydrogen peroxide to the milk kills the bacteria that cause decay. Hydrogen peroxide does not kill all disease-causing bacteria.
The enzyme catalase can be added later to break down the hydrogen peroxide to oxygen and water.
A different way of preserving the milk is by heating it in large machines to 138 °C for a few seconds.
Suggest **one** advantage and **one** disadvantage of using hydrogen peroxide and catalase to preserve milk instead of using heat treatment.

23. Lipase is an enzyme that digests fat.

(a) (i) Complete the equation to show the digestion of fat.

$$\text{fat} \xrightarrow{\text{lipase}} \text{fatty acids} + \_\_\_\_\_$$

(ii) Name **one** organ that makes lipase.

(b) Some students investigated the effect of bile on the digestion of fat by lipase.

Lesson 4-5 Exam Questions

Q1.

A student investigated the effect of pH on the rate of starch digestion.
This is the method used.

1. Add 2 cm^3 of amylase solution at pH 5.0 to a test tube.
2. Add 2 cm^3 of starch solution to the same test tube.
3. Start the timer.
4. Remove one drop of the amylase-starch mixture after 30 seconds.
5. Test the drop for starch.
6. Remove a drop of the amylase-starch mixture every 30 seconds until no starch is detected.
7. Record the total time taken for no starch to be detected.
8. Repeat steps **1** to **7** using amylase solution at different pHs.

The student kept all the solutions in a water bath at 37 °C

(a) What is the independent variable (what is changed) in the investigation?

(b) **Describe the test for starch** and give the **result of the test** if starch is present.

(2)

The table below shows the results.

pH	Time for no starch to be detected in seconds
5.0	420
5.5	330
6.0	270
6.5	240
7.0	120
7.5	90
8.0	120
8.5	180
9.0	270

(c) Using the table above, state what pH range the student used.

(1)

(d) If the optimum pH is when the enzyme works the fastest, what is the optimum pH of this enzyme?

(1)

(e) How could the investigation be improved to get a more accurate value for the optimum pH?

Write one of the following options:

1. Remove one drop of the amylase-starch mixture every minute.
2. Use a less concentrated amylase solution.
3. Use smaller pH intervals.

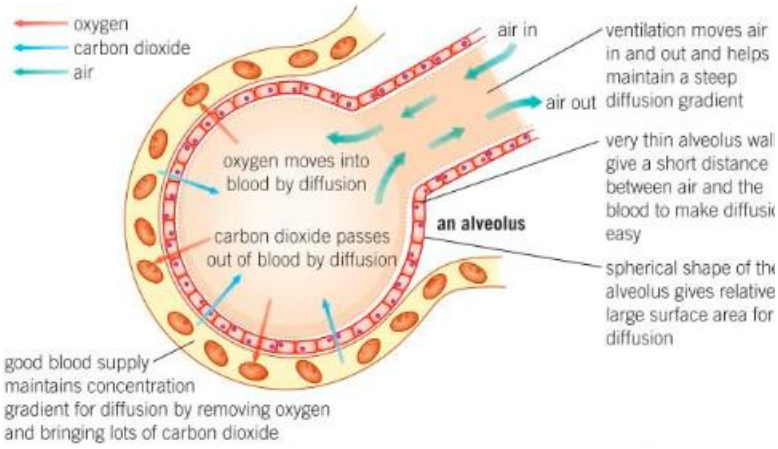
(1)

(f) What is the best way for the student to display the results?
Write one of the following options.

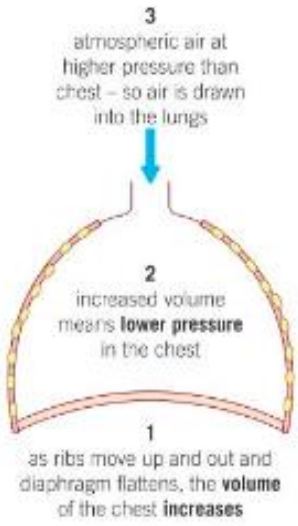
1. Bar chart
2. Frequency table
3. Line graph
4. Pie chart

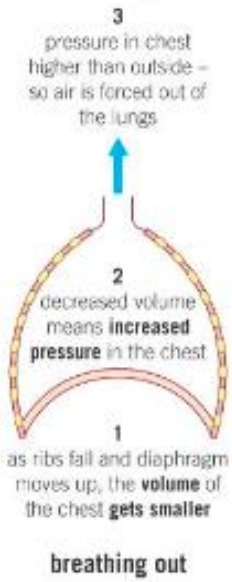
(1)
(Total 7 marks)

Lesson 6: Respiratory System



Your lungs are found in your chest or thorax and are protected by your ribcage. They are found above the organs of your digestive system and are separated from by a layer of muscle called the diaphragm. The lungs are a part of the gas exchange or ventilation system and the role of this system is to move air in and out the lungs. The lungs are made up of tiny air sacs called alveoli which increase the surface area for gas exchange. The walls of the alveoli are very thin (only 1 cell thick) to provide a short diffusion distance for gas exchange. The alveoli also have a rich supply of blood capillaries to maintain a concentration gradient. Ventilation of the lungs is controlled by the contraction or relaxation of the intercostal muscles and the diaphragm which changes the pressure of the lungs resulting in the movement of gases like oxygen in and out the lungs. Oxygen is used for aerobic respiration and so is important as without it we could not release energy.

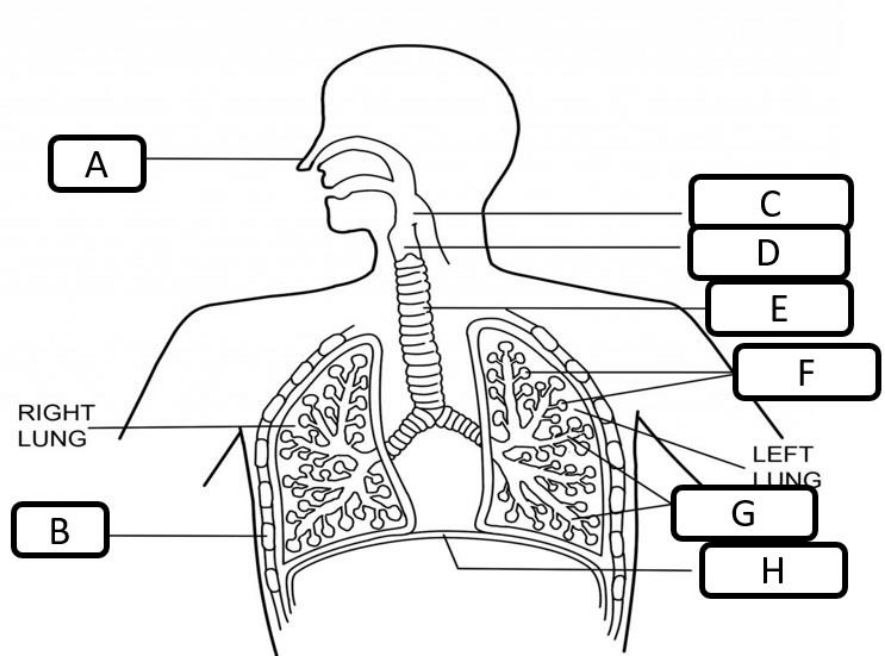




Shown to the left is the process of breathing in and out. When you breathe in, oxygen rich air will move into the lungs. This means there is a high concentration of oxygen in the lungs and maintains a steep concentration gradient between the lungs and the bloodstream. Diffusion causes particles to go from a high concentration to a low concentration and therefore oxygen moves from the lungs to the blood by this process. Breathing out removes carbon dioxide rich air from lungs maintaining a concentration gradient between the bloodstream and the lungs with the blood stream having a higher concentration of carbon dioxide resulting in carbon dioxide continually diffusing out of the blood stream.

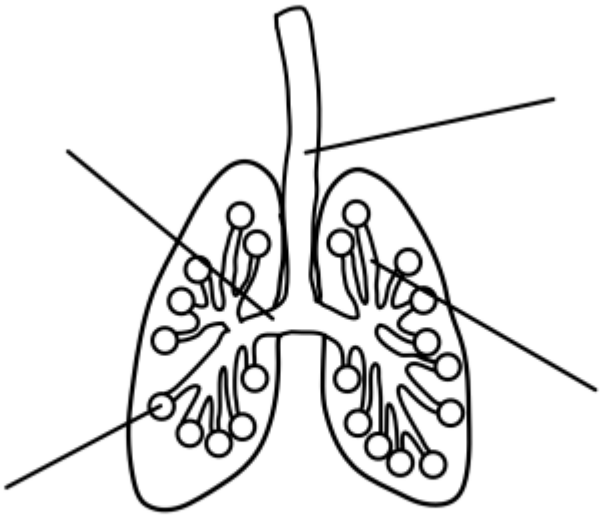
Lesson 6 Mastery Questions:

1. What is the path that air takes through the lungs?
2. What occurs in the alveoli?
3. Describe **one** adaptation alveoli have to allow gas exchange to happen
4. What is the general formula for calculating breathing rate
5. **If someone has a high breathing rate, what does that imply about their activity?**
6. What protects your lungs?
7. What makes red blood cells special?
8. What are the names of the airs sacs in the lungs?
9. Give two adaptations of alveoli
10. State two gasses that are moved in and out of the lungs by ventilation.
11. What two sets of muscles control gas exchange?
12. What is the relationship between volume of the chest and pressure?
13. Describe the changes that will occur in the lungs when breathing in and out
14. Describe the changes that will occur in the lungs when emerging from a dive in water
15. If the pressure in the lung is high, am I breathing in or out?
16. Write the letters and state the parts of the lungs



Lesson 6 Exam Questions

1 Label the structures of the lungs indicated by the arrows in the simplified diagram below.



[4 marks]

2 Name the two gases that we exchange via the lungs and state how they travel around the body

1) .....

2) .....

[4 marks]

3 Why do we need a specialised exchange system to exchange the gases mentioned in Question 2?

.....

.....

[2 marks]

4 State and explain 3 ways in which the alveoli are adapted to their role of gas exchange

1) .....

.....

2) .....

.....

3) .....

.....

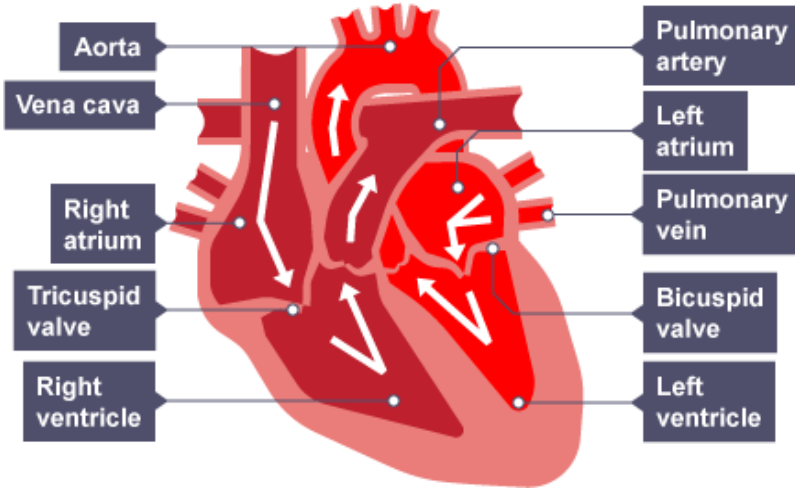
[6 marks]

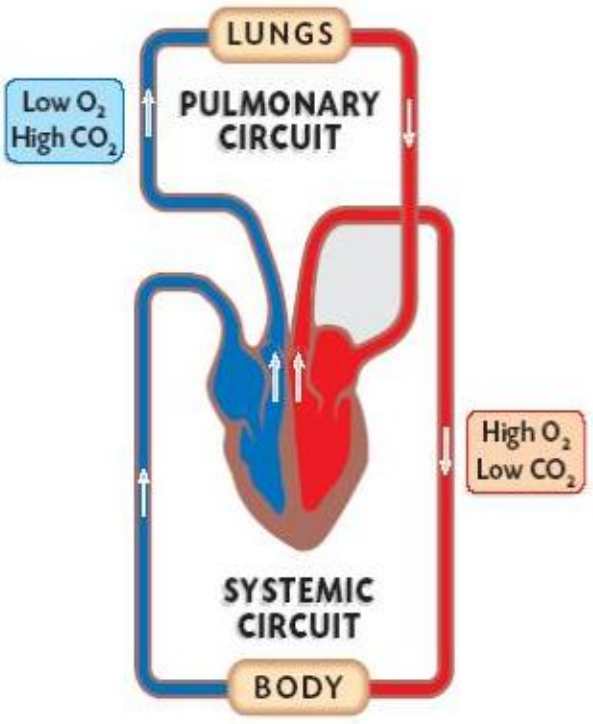
Lesson 7 Structure of the Heart

Your heart is the organ that pumps blood round our body. It is made up of two pumps. The walls of your heart are almost entirely muscle and the blood vessel that supplies the heart with oxygen is called the coronary artery.

Blood enters the **right atrium** through the **vena cava** (a vein that brings deoxygenated blood back to the heart). Blood will then travel from the **right atrium** to the **right ventricle**. The **tricuspid valve** will then close to prevent backflow. When the **right ventricle** contracts deoxygenated blood is forced into the **pulmonary artery** which travels to the **lungs** to pick up oxygen. This newly oxygenated blood is returned to the heart by the **pulmonary vein** into the **left atrium**. Blood flows into the **left ventricle**, the **bicuspid valve** closes to prevent backflow. The **left ventricle** pumps oxygenated blood around the body via the **aorta**. Whenever blood enters the aorta or pulmonary artery valves at the beginning of these vessels close. The muscle wall of the left ventricle is thicker than elsewhere. This allows the blood leaving the left ventricle to be under the high pressure needed to pump it round the **body**.

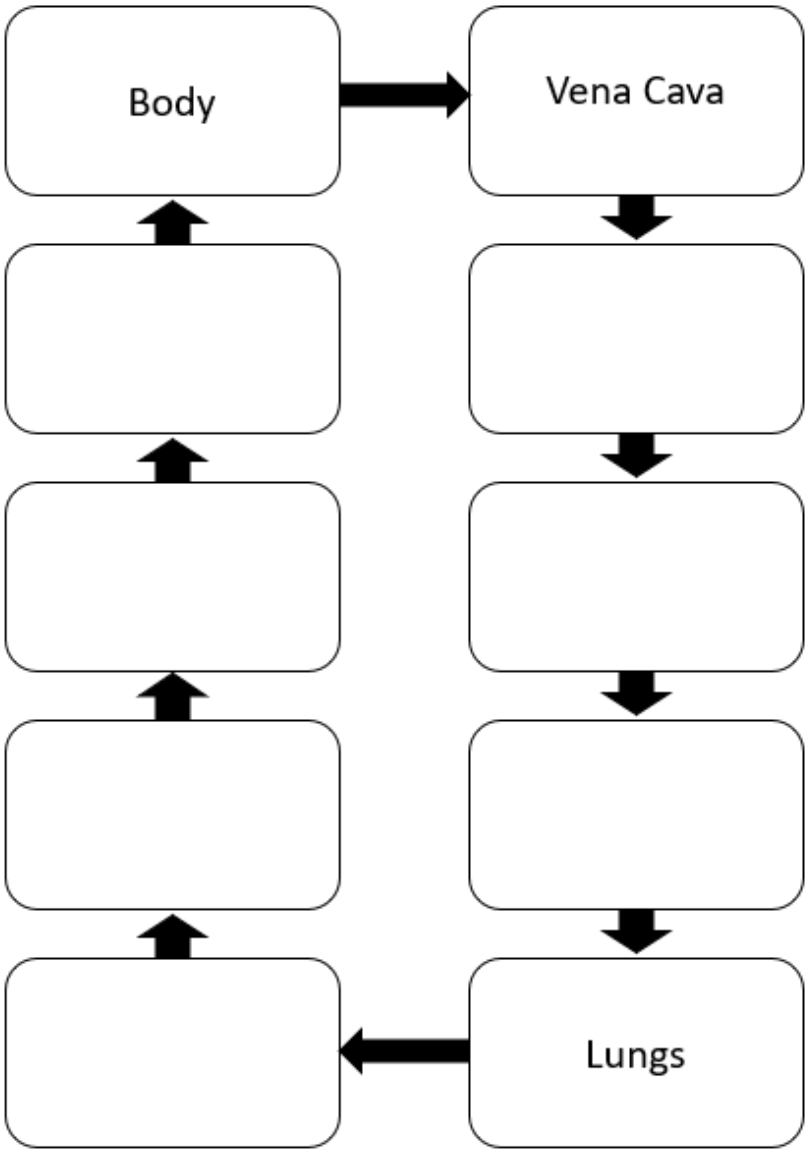
The cardiovascular system in mammals is known as a **double circulatory system-** this means, that blood is moved through the heart twice in one circuit of the body. **Deoxygenated** blood is received by the right atrium, moving through the chambers before leaving through the **pulmonary artery** towards the lungs. This is the first circuit. It then returns to the left atrium through the pulmonary vein, again moving through the chambers before being pumped to the rest of the body through the **aorta.** This is the second circuit. The walls of the left ventricle are thicker, with more muscle, to allow blood to be pumped further around the body.





Lesson 7 Mastery Questions

1. Copy and complete the diagram, adding information to show where the blood goes next.



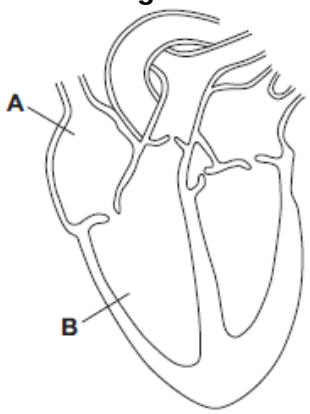
2. What is the name of the blood vessels that supply the heart with oxygen?
3. What is the name given to the top chambers of the heart?
4. What blood vessel supplies the left atrium with blood?
5. What blood vessel supplies the right atrium with blood?
6. What is special about the pulmonary artery?
7. The circulatory system contains arteries and veins.
    a) Describe how the structure of an artery is different from the structure of a vein.
    b) A comparison is made between blood taken from an artery in the leg and blood taken from a vein in the leg.
    c) Give two differences in the composition of the blood.

Lesson 7 Exam Questions

Q1.

Diagram 1 shows a section through the heart.

Diagram 1



(a) Use words from the box to name the structures labelled **A** and **B** on **Diagram 1**.

aorta	**atrium**	**pulmonary artery**	**ventricle**

(2)

(b) The tissue in the wall of the heart contracts.

(i) What type of tissue is this?

Choose **one**

Muscular Glandular Epithelial

Tick (✓) **one** box.

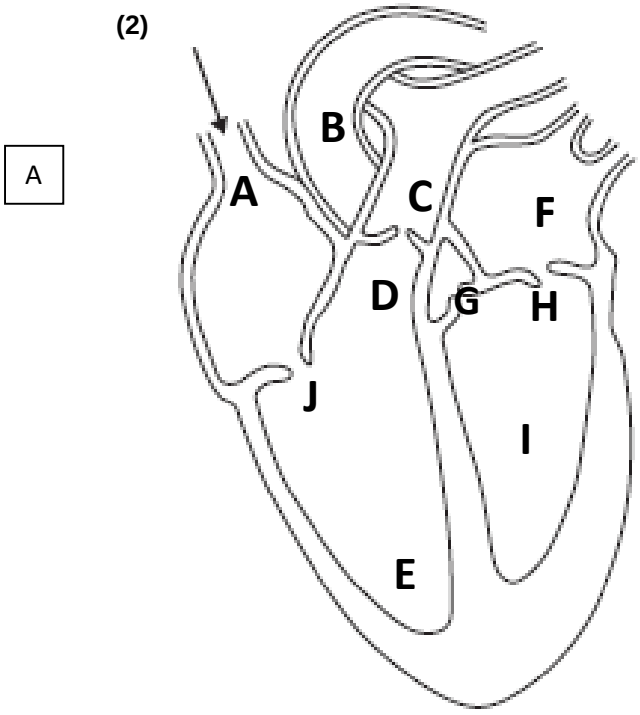
(1)

(ii) What does the heart do when this tissue contracts?

(1)

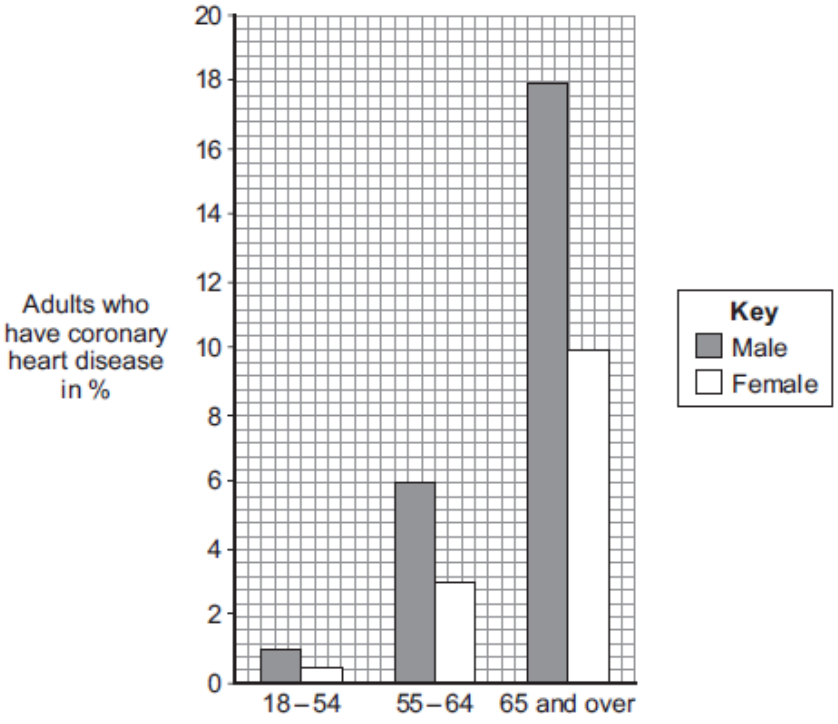
(c) Write the order that blood goes through the heart, using the letters on the drawing below.
Assume it starts at **A,** but *it does not go through in alphabetical order!*

Diagram 2



(2)

(d) The graph shows the percentage (%) of adults in the UK who have coronary heart disease.



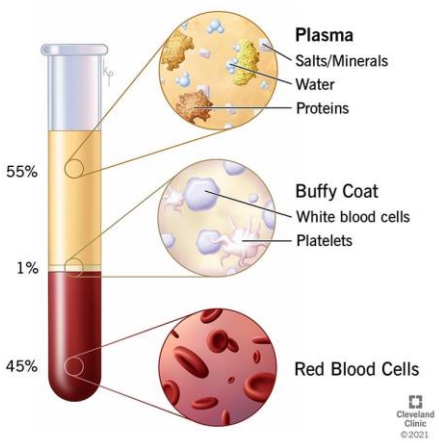
(i) Look at the graph.
Which group of people is **most** at risk of having coronary heart disease in the UK?

(2)

(Total 11 marks)

Lesson 8 Blood Vessels and Components of the Blood

Blood has four main components: **red blood cells**, **white blood cells**, **platelets** all of which are carried in a fluid called **plasma**. Within the plasma dissolved substances like glucose (plus other products of digestion, urea and carbon dioxide will also be carried.

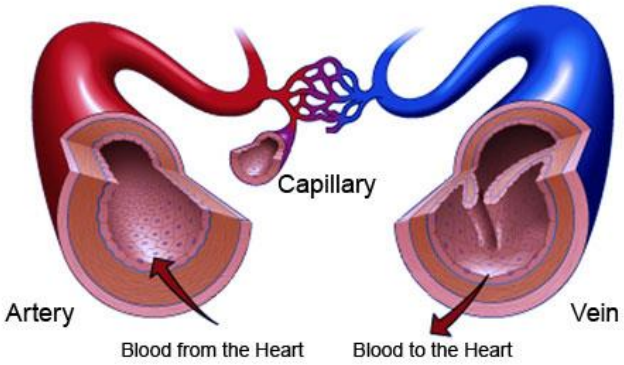


Red blood cells carry the oxygen from the air in our lungs to our respiring cells. Red blood cells have certain adaptations that make them efficient at their job. They are biconcave disks which increases their surface area to volume ratio which increase diffusion. They are packed with haemoglobin which binds to oxygen. They also have no nucleus which makes space for more haemoglobin.

White blood cells form part of the immune system. Some white blood cells (lymphocytes) produce antibodies whilst others produce antitoxins and yet others (phagocytes) engulf and digest invading microorganisms.

Platelets are small fragments of cells without a nucleus. They are involved in the clotting of blood. Blood clotting is a series of enzyme-controlled reactions that results in the conversion of fibrinogen into fibrin. This forms a network of fibres that traps more platelets and red blood cells forming a scab which protects the new skin as it grows.

Blood is carried round our body in three vessels, adapted to their function.



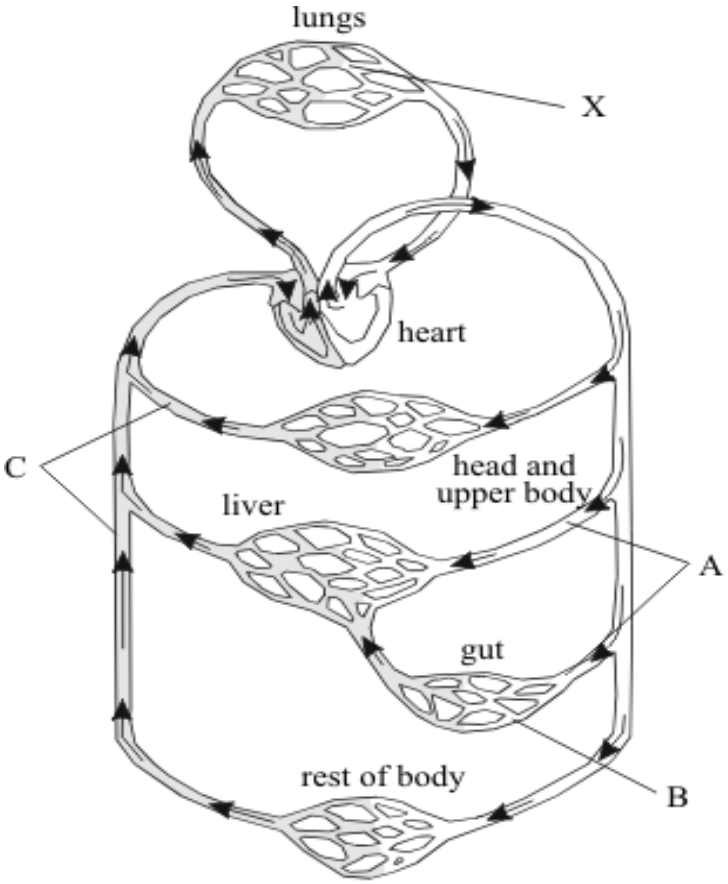
Arteries carry blood away from the heart to the organs or body. The blood is usually oxygenated with the exception of the pulmonary artery. Blood in the arteries is under high pressure. Arteries have a thick layer of muscle and elastic fibres along with thick walls to allow them to withstand the high pressure and to stretch. Arteries have a small lumen.

Veins carry blood away from organs towards the heart. The blood is low in oxygen, except for the pulmonary vein. Veins have a larger lumen and relatively thin muscular and elastic walls. This is because the blood is under less pressure. Veins have valves to prevent blood flowing backwards.

Capillaries connect arteries to veins. Capillaries are very narrow with thin walls. This ensures there is a short diffusion distance between the inside of the capillary and surrounding cells. This enables substances such as glucose and oxygen to easily diffuse out of your blood into cells. Conversely carbon dioxide can easily do the opposite. Capillaries have very narrow lumens which only allow 1 cell to pass through at a time and their walls are only 1 cell thick.

Lesson 8 Mastery Questions

1. What is blood made up of?
2. Name 5 things found in plasma
3. What is the job of red blood cells?
4. What is the job of haemoglobin?
5. State two adaptations of red blood cells
6. Explain how being biconcave is useful
7. How can white blood cells protect us against infection?
8. What type of cell contains 0 chromosomes?
9. What are the three types of blood vessel?
10. What type of blood vessel carries blood away from the heart
11. Why do the arteries have a thick layer of elastic fibres and muscle tissue?
12. What is the pressure like inside the arteries?
13. Red blood cells have no nucleus, What is the function of the nucleus?
14. What do veins have that prevent back flow?
15. How is the pulmonary vein different to other veins?
16. What process will allow oxygen to move from the red blood cells into the muscle cells.
17. Order the blood vessels from largest lumen to smallest lumen
18. What is the benefit of the walls of capillaries only being 1 cell thick



19. Why is our circulation system described as a double circulation system?
20. What diffuses from the capillaries into cells? Name the types of blood vessel labelled A, B and C on the diagram.
21. What is the job of the circulatory system?
22. Give **two** ways in which the composition of blood changes as it flows through the vessels labelled X on the diagram.

Lesson 8 Exam Questions

Q1.

(a) Write the correct word for each numbered question

(i) Which type of blood vessel carries blood out of the heart?

artery **capillary** **vein**

(1)

(ii) Which type of blood vessel allows substances to enter and leave the blood?

artery **capillary** **vein**

(1)

(b) Copy and complete the sentences below, using words from the box to complete the sentences.

alveoli	**cell membrane**	**nucleus**
plasma	**red blood cells**	**villi**

Oxygen enters the blood through the walls of the _____ .

Most of the oxygen transported by the blood is carried in the _____ .

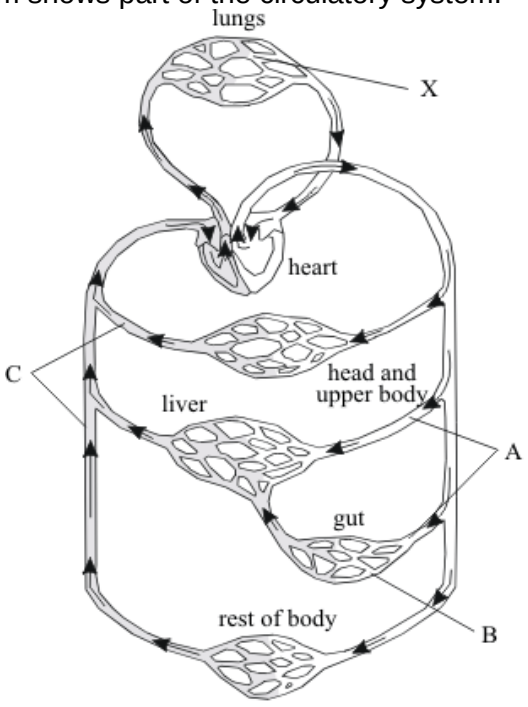
A red blood cell is different from other body cells because it does not have a _____ .

(3)

(Total 5 marks)

Q2.

The diagram shows part of the circulatory system.



(a) Name the types of blood vessel labelled A, B and C on the diagram.

(3)

(b) What is the job of the circulatory system?

(1)

(c) Give **two** ways in which the composition of blood changes as it flows through the vessels labelled X on the diagram.

(2)

(Total 6 marks)

Lesson 9 Non-Communicable Diseases and Cancer

Good health is defined as a state of complete physical, mental and social wellbeing. Things that can reduce a person's health include disease, diet and stress.

Diseases can interact to create unexpected consequences. Some examples are:

- 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.

One of the biggest impacts on a person's life is their diet. If a person takes in more calories than they use they will increase in body mass. IF this gets to an extreme level they can be classified as obese. One of the biggest problems with obesity is the chance of developing type 2 diabetes.

Cancer is uncontrolled cell division. A tumour is a group of cells that are dividing uncontrollably. Tumours come in 2 forms, benign and malignant. Benign tumours are normally located in one place and do not invade other parts of the body. A benign tumour can be dangerous if found near an important organ. However, in general they are less likely to cause death than malignant tumours. A malignant tumour can spread around the body by invading other parts. A malignant tumour is often called cancer. Cells from a malignant tumour can break off from the larger tumour and go into the blood to be transported to other places in the body.

Different cancers can be caused by different things. For example, a genetic mutation passed down from parents causes some breast cancers. Chemicals like tar and asbestos can cause our DNA to mutate which can lead to cancer. These chemicals that cause our DNA to mutate are known as carcinogens. Ionising radiation like UV light and X-rays can also cause mutations that lead to cancer.

Due to how it can spread throughout the body, cancer can be hard to treat. Radiotherapy is one way cancer can be treated. This involves using targeted doses of radiation to treat cancer cells. Radiotherapy works by disrupting mitosis. However, it can also affect healthy cells. Another way to treat cancer is chemotherapy which involves using chemicals to stop the cancer cells dividing or make them 'self-destruct'.

Lesson 9 Mastery Questions

1. Define health
2. What is the word to describe someone with a large body mass for their height?
3. What is the main consequence to obesity?
4. Define cancer
5. Define a tumour
6. Distinguish between the two types of tumour
7. State three causes of cancer
8. Define a carcinogen
9. Describe two ways of treating cancer
10. Explain why scientists are still trying to find new ways of treating cancer

Maths Skills

11. **Calculating a mean-** State the name of the cancer and work out the mean number of deaths (add all up, divide by total) and the percentage change (increase / original number *100)

Type of cancer	Number of deaths in 2014	Number of deaths in 2016	Mean number of deaths	Calculating percentage change
Lung cancer	12,700	13,000		
Prostate cancer	6478	8001		
Leukaemia	14,300	11,000		
Bowel cancer	3678	4352		
Breast cancer	9,000	8421		
Skin cancer	766	861		

12. Describe the trend in number of deaths by breast cancer over time (2)
13. Describe the pattern between number of deaths by bowel cancer and time
14. Compare the change in number of deaths over time for leukaemia and lung cancer
15. A newspaper runs an article with the headline 'deaths by cancer are at an all time high!!!' Evaluate the claims made by this newspaper using the data above

Lesson 9 Exam Questions

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

(a) (i) Describe how tumours form.

(1)

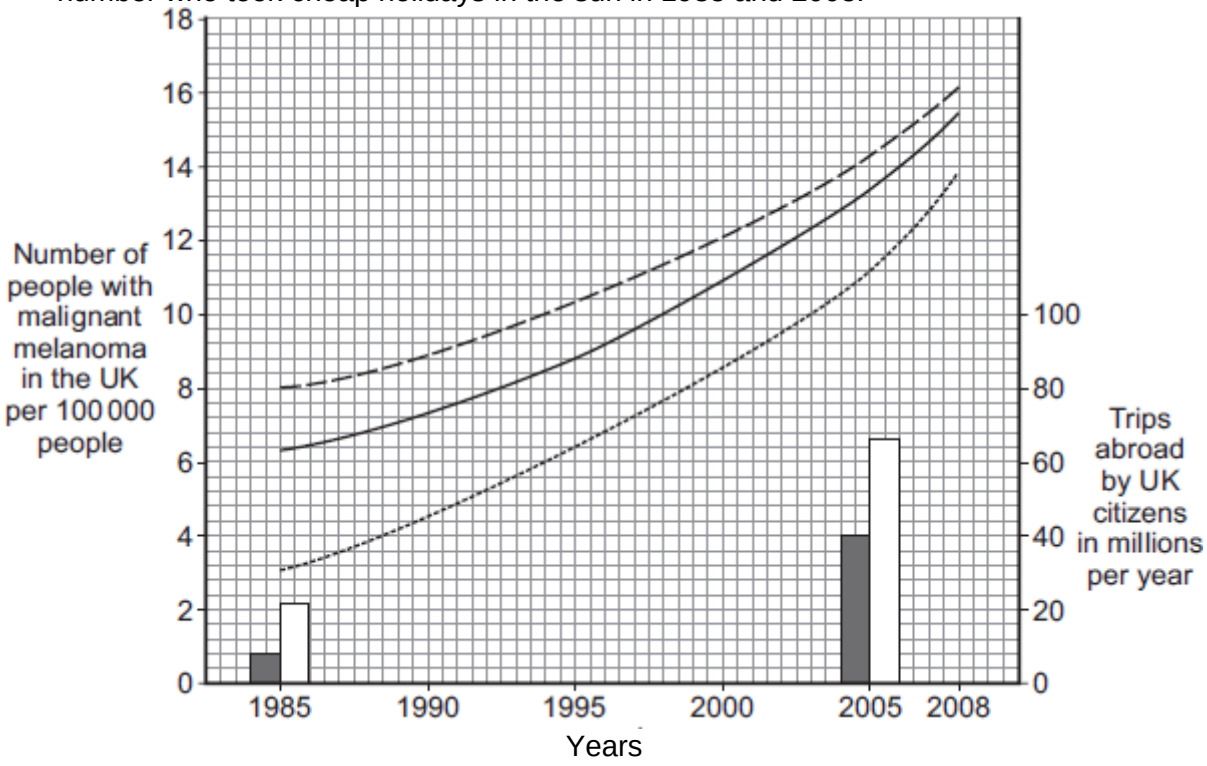
(ii) Tumours can be malignant or benign.
What is the difference between a malignant tumour and a benign tumour?

(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)

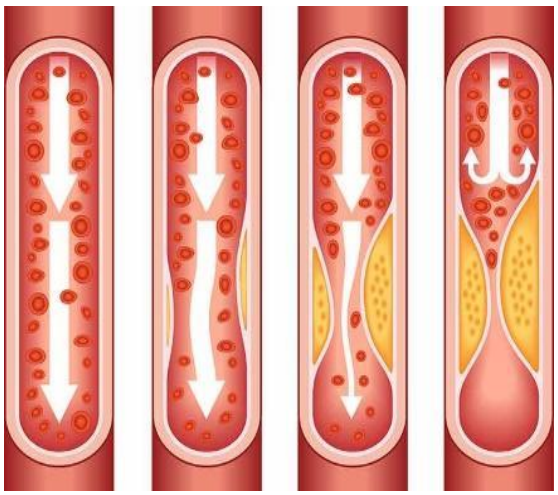
Lesson 10: Cardiovascular Disease

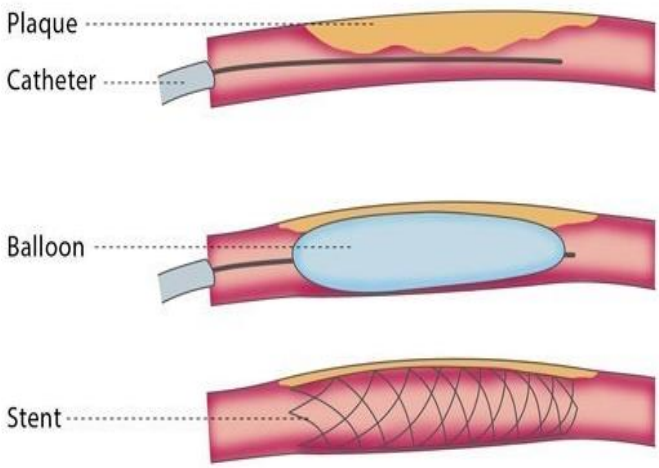
Coronary heart disease is caused by the narrowing of the **coronary arteries** that supplies the heart muscle cells with blood, which contains oxygen. This is caused by a build-up of fatty material on the lining of the vessels which reduces the supply of oxygen to the heart. Coronary heart disease can be treated with a stent. A stent is a metal mesh placed in the artery.

A tiny balloon is then inflated to open the blood vessel and the stent. The balloon is then removed but the stent ensures the blood vessel remains widened. Stents don't require general anaesthetic and can be placed anywhere in the body.

Another option is bypass surgery where the blocked artery is replaced with bits of veins. This requires surgery and general anaesthetic but can be used on extremely blocked arteries where stents can't help.

A preventative option is to prescribe statins. Statins reduce blood cholesterol levels which slows down the rate at which fatty material is deposited. However, it can't be used to treat advanced coronary artery disease as it won't reduce current blockages.





Treating CVD

Heart valves have to withstand a lot of pressure. As such they may start to leak. Doctors can operate and replace faulty valves with mechanical valves made of titanium. These mechanical valves are long lasting but require medication to prevent blood clotting around it. Biological valves are based on valves from pigs or even human donors. These do not require any medication but only last 12-15 years.

The heart normally beats at 70bpm. The beating of the heart is controlled by a group of cells found in the walls of the right atrium. This cluster of cells can stop working and needs replacing with an artificial pacemaker. If a person's heart beats too slowly they won't get enough oxygen. The most common disease treated by pacemakers is arrhythmia (abnormal

heart rhythm). An artificial pacemaker is an electronic device that weighs between 20-50g and is connected to your heart by two wires. They control when the heart beats by sending strong , regular electronic signals to the heart. Modern pacemakers are very sensitive and only act when something is amiss and can even stimulate the heart to beat faster when you exercise. If you have a pacemaker fitted you will need regular check-ups throughout your life, however, this is a small price to pay when weighed against the increased quality and quantity of life gained by having one.

Artificial hearts are used when a person's heart stops working completely. It can take a long time for a donor heart to become available, so artificial hearts are used to keep the patient alive in the meantime. There is a risk of blood clotting with artificial hearts.

On the following page are two treatments, and advantages and disadvantages of their use.

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

Lesson 10 Mastery Questions

1. What type of blood is found in the right ventricle?
2. What causes coronary heart disease?
3. What are three methods of treating coronary heart disease?
4. Why does the left ventricle have thick muscular walls?
5. What is an advantage of stents?
6. How do stents work?
7. What is a disadvantage of bypass surgery?
8. Evaluate the use of three methods of combating coronary heart disease (hint: evaluation is pros, cons and then choosing which one is best overall)
17. What two methods of replacing heart valves?
18. What is an advantage and disadvantage of each method?
19. What is the danger if a person's heart beats too slowly?
20. What is the disadvantage of wearing a pacemaker?
21. Why are artificial hearts used?
22. What is the risk of artificial hearts?

Lesson 10 Exam Questions

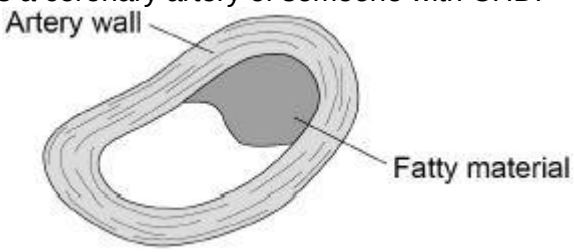
Q1.

Coronary heart disease (CHD) is a non-communicable disease.
CHD is caused when fatty material builds up in the coronary arteries.

(a) Explain what a non-communicable disease is.

(2)

The diagram below shows a coronary artery of someone with CHD.



(b) Explain how CHD can cause a heart attack.

(3)

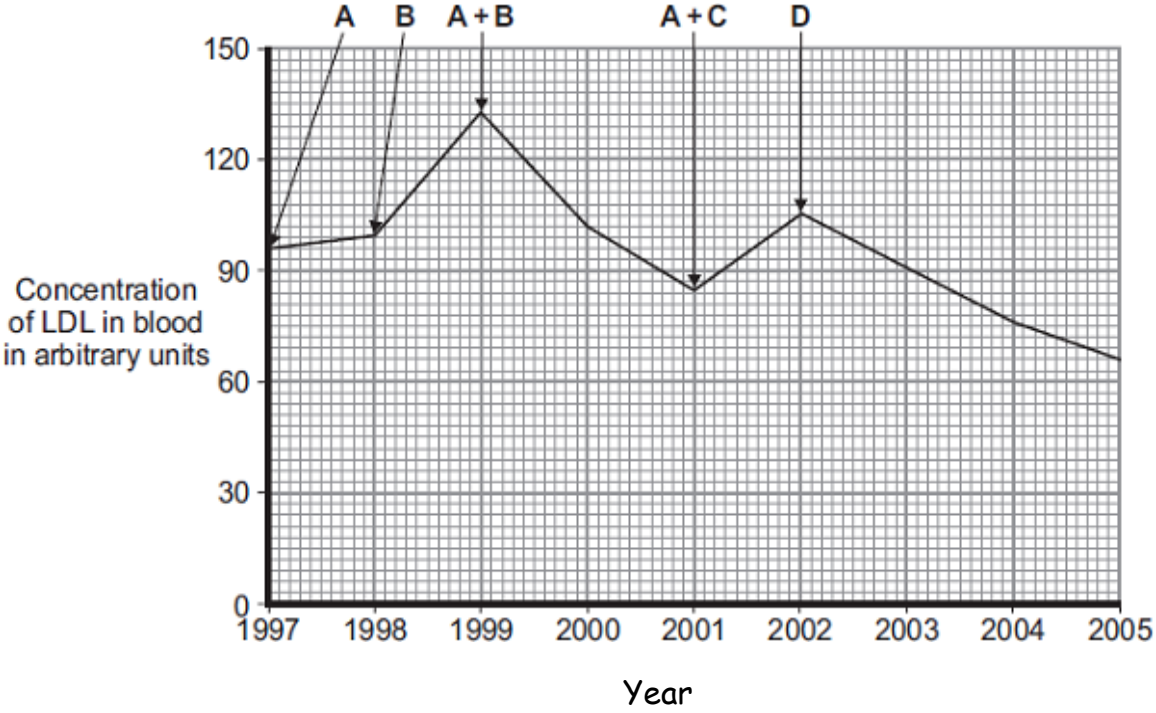
(c) Explain how lifestyle and medical risk factors increase the chance of developing CHD.

(6)

(Total 11 marks)

1. The circulatory system contains arteries and veins.
    a. Describe how the structure of an artery is different from the structure of a vein.
    b. A comparison is made between blood taken from an artery in the leg and blood taken from a vein in the leg.
    c. Give two differences in the composition of the blood.

2. LDL is one form of cholesterol found in the blood.
    a. People with a high concentration of LDL in their blood may be treated with drugs called statins.
    b. A high concentration of LDL cholesterol in the blood may result in an increased risk of heart and circulatory diseases.
    c. The graph shows the effects of the treatment of one person with four different statins,
    d. A, B, C and D, over a period of 8 years. The arrows show when each new treatment was started.
    e. Each treatment was continued until the next treatment was started.



Compare the effectiveness of the five treatments in reducing the risk of heart and circulatory diseases for this person.