

**Condensed Biology curriculum
from grade 9-12
designed for grade 12 tutorial program**

Preface

Dear teachers,

Addis Ababa City administration Education Bureau has prepared this condensed Biology curriculum highlighting on the core lesson notes and selected some key questions based on the syllabus and past exam papers.

As a professional, feel free to modify, add extra explanations or include examples that you think will help students especially, if you know where the students usually struggle. Moreover, you can bring in your own teaching experiences; employ different techniques to keep the students engaged for the 8-hour tutorial classes.

Generally, the program emphasizes ensuring students' engagement in ample practices and completing the sessions with greater confidence that would enhance their readiness for the university entrance examination.

For grade 12 students

Lesson 1 (2hrs)

Topic 1. Cell biology

1.1 The Microscope

1.2 The cell

1.3 The cell and environment

Objectives:-

At the end of this section, the student will be able to:

- Explain and demonstrate basic techniques using a light microscope.
- Explain the purpose of staining cells.
- List advantages and disadvantages of light and electron microscope
- **Microscope** is biological tool which is used to magnify and resolves given specimen

There are two main types of microscopes in use, the **light microscope** and the **electron microscope**.

The light microscope uses a beam of light to form the image of an object, while the electron microscope uses a beam of electrons to form an image.

Questions

- 1 .list the parts of light microscope
2. Explain function of each part of light microscope
3. Write Advantages and disadvantages of the light microscope
4. A grade 12 students marked two dots close to each other using a pen on piece of Paper observed them under the microscope the two dots appear well and separated this was due to(2017)

The basic light microscope techniques involves:-

- i .Preparing slide
- ii. Placing it on the stage
- iii. Starting with the lower power
- iv .Observe it with the lowest power objectives

- v. Use the coarse and fine focus knobs to find and sharpen the image
- vi. Then progressively increase the magnification
- To calculate the magnification of the specimen, you multiply the magnification of the objective lens by the magnification of the eyepiece lens.

Question 1. A biologist is studying spherical cell with an actual diameter of $5\mu\text{m}$ under compound light microscope having eye piece lens of 10x magnification. If he wants to enlarge this diameter to 5mm , which lenses he has to use ?

Advantage of Electron microscope

- Has superior magnification and resolution
- Allowing for detailed view of very small structures
- Provides 3D images

Disadvantage of Electron microscope

- Too expensive
- Requires specimen to be placed in vacuum
- Involve difficult sample preparation

Question Compare and contrast light and electron microscope

1.2 The cell

Objectives

At the end of this section, the student will be able to:

- State the cell theory.
- List the structures of cells and describe their function

Brain storming question Explain the theory of cell?

Cell is the basic structural and functional unit of living organisms

Structures and functions in unspecialized animal cells

All cells have some features in common and we can see them clearly in typical unspecialized animal cells (like the ones on the inside of your cheek).

They contain small units called **organelles**. Many of these organelles contain enzymes and chemicals to carry out specialized jobs within the cell.

- The **nucleus** controls all the activities of the cell. It also contains the instructions for making new cells or new organisms in the form of long threads known as **chromosomes**.

- The **cytoplasm** is a liquid gel in which most of the chemical reactions needed for life take place.

About 70% of the cytoplasm of a cell is actually water!

The cytoplasm contains all the other organelles of the cell where most of the chemical reactions take place.

- The **cell membrane** forms a barrier like a very thin ‘skin’ around the outside of the cell.

The membrane controls the passage of substances such as carbon dioxide, oxygen and water in and out of the cell. Because it lets some substances through but not others it is known as selectively permeable.

- The **mitochondria** (singular: mitochondrion) are the powerhouse of the cell.

They carry out most of the reactions of respiration, whereby energy is released from the food in a form your cells can use. Whenever cells need a lot of energy –such as muscle cells and secreting cells – you will see a lot of mitochondria.

- The **endoplasmic reticulum** is a three-dimensional system of tubules that spreads right through the cytoplasm. It links the nucleus with the cell membrane.

- The **ribosomes** are found on the endoplasmic reticulum in your cells. They are vital for protein synthesis, the process by which your body makes all the enzymes that control the reactions of your cells.

Question

1. List the organelles which are common to both animals and plants
2. list the organelles which are found only in plants and explain their function

Sample Question from ESSLCE

3. Unlike animal cells, plant cells have (2016)
4. The cell theory states that(2014/15)
5. From the following alternatives select the common features that are found both in plants and animals (2017)

1.3. The Cell and Its Environment

Objectives:

At the end of this section, the student will be able to

- Describe the permeability of the cell membrane.
- Describe the process of diffusion and its importance in living organisms.
- Explain the process of osmosis and its importance in living organism
- Explain plasmolysis and turgor pressure.
- Explain passive and active transport across cell membranes.

Brain storming questions;

1. Briefly describe diffusion , osmosis and active transport

Dissolved substances can move into and out of our cells across the cell membrane in three different ways - by **diffusion**, **osmosis** and **active transport**.

A .Diffusion: the net (overall) movement of particles from an area of high concentration to an area of lower concentration.

It is passive transport—does not require energy

It takes place because of the random movements of the particles of a gas or of a substance in solution in water.

Concentration is a way of measuring how much (how many particles) of a substance is in one place.

The overall /net movement = Particles moving in - Particles moving out

Rate of Diffusion

What factors affect the rate of diffusion and how they affect?

A number of different factors affect the rate at which it takes place.

- ❖ Temperature: higher temperature increases the kinetic energy of temperature
- ❖ Concentration gradient: a steeper difference in concentration leads to a faster rate of diffusion
- ❖ Surface area: a larger surface area increases the rate of diffusion.
- ❖ The size of diffusion molecules: smaller molecules diffuse faster than larger ones.

B. Osmosis: a special type of diffusion where only water moves across a partially permeable membrane, from an area of high concentration of water (low concentration of solute) to an area of lower concentration of water (high concentration of solute).

Types of Osmotic conditions includes: isotonic solutions, hypertonic a solution and hypotonic solution

If the concentration of the solutions on both sides of a cell membrane are the same they are **isotonic**.

If the concentration of the solution on the outside of the cell membrane is higher than the concentration of the solution inside the cell it is **hypertonic**.

If the concentration of the solution on the outside of the cell membrane is lower than the concentration of the solution inside the cell it is **hypotonic**.

Osmosis in animals

- Osmosis causes animal cells to gain or loss water and change shape, potentially leading to bursting or shivering if the external solution is too dilute (hypotonic) or too concentrated (hypertonic), respectively

Question:

What will happen on the animal cell if the conditions in a) isotonic b) hypertonic c) hypotonic

Osmosis in Plants

- Osmosis in plants causes water to move into the roots from the soil and travel up the stem to the leaves. When a plant cell is in a solution with a higher water concentration, it takes in water, becomes firm (turgid), and maintains structural support. If a plant loses too much water, its cells become flaccid and the plant wilts.
- If water continues to leave the cell by osmosis, eventually the cytoplasm pulls away from the cell walls and the cell goes into a state known as **plasmolysis**.

Question:

1. When the plant cell gain water continually by osmosis , they become swell and turgid .
Here in the turgidity leads the plant cell to.... (2017)

2. Consider the following two experiments which show the process of osmosis.

Experiment A; 3cm of two potato cylinder were added to test tube contained 10ml of distilled water

Experiment B. 3cm of two potato cylinder were added to test tube contained 10ml mixed solution

0.8M sucrose and distilled wate. The final weight of potato cylinder in experiment A will be...(2017)

3. Suppose a student conducted an experiment using onion epidermal cells. He placed it on a slide and added a drop of salt solution more concentrated than the cell sap. After an hour, he observed the specimen under a microscope. What would happen to the onion cells?

(From ESSLCE)

4. Classes of grade 11students were given two solutions A and B of unknown concentration separated by a semi permeable membrane. The teacher instructed them to observe any changes in the water levels of the two solutions. After few minutes, the students observed the water level in solution A has decreased. What could the students conclude from their observation? (From ESSLCE)

C. Active transport: the movement of molecules from region of lower concentration to region of high concentration

Importance of Active transport

- ❖ Mineral absorption
- ❖ Cellular balance
- ❖ Nerve function...etc

Question 1. Explain how active transport is used in mineral absorption

Lesson 2 (2hrs)

Topic 2 . Human Biology and Health

2.2. Food and Nutrition

Objectives:

At the end of this section, the student will be able to

- List the major nutrients needed by human body and their source
- Describe the functions and the structures of the human digestive system.
- Describe the processes of digestion in the mouth, stomach and small intestine.

The Human diet

Food is the source of nutrients and energy for the body

We use our food in three main ways:

- To provide energy for our cells to carry out all the functions of life
- To provide the raw materials for the new biological material needed in our bodies to grow and also to repair and replace damaged and worn out cells.
- To provide the resources needed to fight disease and maintain a healthy body.

Some types of food are needed in large amounts – these are known as the **macronutrients**.

Includes: carbohydrates, proteins and lipids

Some are needed in small amounts-**micronutrient** (vitamins, minerals)

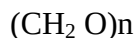
Carbohydrates

Carbohydrates provide us with energy. Much of the carbohydrate you take into your body is broken down to form glucose, which is used in cellular respiration to produce energy.

The most commonly known carbohydrates are the sugars and starches.

The simple sugars

In these simple sugars there is one oxygen atom and two hydrogen atoms for each carbon atom present in the molecule. This can be written as a general formula:



The best-known simple sugar is glucose, which has the chemical formula $\text{C}_6\text{H}_{12}\text{O}_6$. There are lots of other simple sugars, including fructose, the sugar found in fruit.

The double sugars

Double sugars are made up of two simple sugars joined together, and sucrose (the substance you know as sugar) is one of the most common. It is formed by a molecule of glucose joining with a molecule of fructose. When two simple sugars are joining together to form a double sugar, a molecule of water (H_2O) is removed. This type of reaction where water is produced is known as a condensation

Disaccharide	Source
Sucrose	Stored in plants such as sugar beet and sugar cane
Lactose	Milk sugar – this is the main carbohydrate found in milk
Maltose	Malt sugar – found in germinating seed such as barley

The complex sugars

The most complex carbohydrates are formed when many single sugar units are joined to form a long chain.

These complex sugars have some very important biological properties. They often form very compact molecules that are ideal for storing energy

Starch is one of the best-known complex sugars. It is particularly important as an energy store in plants. The sugars produced by photosynthesis are rapidly converted to starch. Particularly rich sources are plant storage organs such as potatoes.

Glycogen is sometimes referred to as ‘animal starch’. It is the only carbohydrate energy store found in animals. It is found mainly in muscle and liver tissue, which is very active and needs a readily available energy supply at all times

- Cellulose is an important structural material in plants. It is the main constituent in plant cell walls.

Question

1. Write the function of cellulose
2. Write the difference between simple sugar and double sugars
3. What are hydrolysis and condensation reactions?
4. List the function of carbohydrate (2016)
5. Write the molecular formula of pentose sugar (2016)

6. The missing number represented by the letter "n" in the formula of maltose ($C_{12}H_nO_{11}$)
....(2016)

Proteins

- Proteins are used for body-building.
- Protein-rich food includes all meat and fish, dairy products such as cheese and milk as well as pulses, such as white pea beans, chick peas and red kidney beans.

Amino acids: building block of protein

Peptide link when amino acids are joined together in a condensation reaction and a molecule of water is lost

Question

1. How do test the presence of protein in food?
2. Assume that you did series of biochemical tests for unknown food , it showed a blue color when tested with Benedict solution. After the test of hydrolysis or and neutralization, the food gave a red precipitate with Benedict test. What do you expect on the contents of the food ? It contains most probably... (2017)

Fats and oils

Lipids general name for fats and oils.

Fats and oils are an extremely important group of chemicals with major roles to play in your body. They are an important source of energy in your diet and they are the most effective energy store in your body. They contain more energy per gram than carbohydrates or proteins.

All lipids are insoluble in water, but dissolve in organic solvents.

The best-known lipids are the fats and oils

Fats are solid at room temperature.

It can be saturated (with no double bonds between structure), or unsaturated (double bonds between structures).

Question.

A man eats only vegetables, banana, beans, and orange for one week continuously in his lunch and dinner. For this man, what nutrients are most likely missed in his meal to be balanced diet... (2016)

Minerals

Minerals is a nutrient that needed in small amounts to keep the body healthy.

Mineral	Approximate mass in an adult body (g)	Location or role in body	Examples of foods rich in mineral	Effects of deficiency
Calcium	1000	Making bones and teeth	Dairy products, fish, bread, vegetables	Rickets
Phosphorus	650	Making teeth and bones; part of many chemicals, e.g. DNA	Most foods	Improper formation of teeth and bones; failure of metabolism
Sodium	100	In body fluids, e.g. blood	Common salt, most foods	Muscular cramps
Chlorine	100	In body fluids, e.g. blood	Common salt, most foods	Muscular cramps
Magnesium	30	Making bones; found inside cells	Green vegetables	Skeletal problems; cell chemistry affected, defects in metabolism
Iron	3	Part of hemoglobin in red blood cells; helps carry oxygen	Red meat, liver, eggs, green leafy vegetables, e.g. spinach	Anaemia

Vitamins

Vitamins are a group of substances that are needed for normal cell function.

Vitamin	Recommended daily amount in diet	Use in the body	Some good sources of the vitamin	Effect of deficiency
A	0.8 mg	Making a chemical in the retina; also protects the surface of the eye	Fish liver oils, liver, butter, margarine, carrots	Night blindness; damaged cornea of eye
B1	1.4 mg	Helps with cell respiration	Yeast extract, cereals	Beri-beri
C	60 mg	Sticks together cells lining surfaces such as the mouth	Fresh fruits and vegetables	Scurvy
D	5 g	Helps bones absorb calcium and phosphorus	Fish liver oils; also made in skin in sunlight	Rickets; poor teeth

Questions

1. Discuss the types of vitamins, minerals with their sources and deficiency diseases.
2. Why balanced diet is important?
3. A student conducted a food test on three unknown food samples and obtained results as presented in the table below.

No	Procedures used	Color changes of the food samples after the experiment		
		Food sample 1	Food sample 2	Food sample 3
1	Mixed with Benedicts reagent and heated	Blue	Red	Yellow
2	Mixed with ethanol and poured into water	Colorless	Colorless	Colorless
3	Mixed with Biurets reagent	Mauve	Mauve	Mauve
4	Iodine	Brown	Brown	Brown

What do you conclude from the result of the above experiment? (2016)

4. If your body cannot make enough red blood cells , what type of minerals rich food can correct this problem...(2017)

Lesson 3(2hrs)

2.2 The digestive system

Objectives :-

At the end of this section, the student will be able to

- Describe the functions of the structures of the human digestive system
- Define enzymes and describe their role in the process of digestion
- Describe the structure of the teeth and explain their importance
- Describe the processes of digestion in the mouth, stomach and small intestine
- Explain how the products of digestion are absorbed and assimilated by the body.

Brain storming question 1.Describe the type of digestion

The digestive system is the process of breaking down complex and insoluble foods into simple and soluble forms (nutrients)that the body can use for energy , growth and repair

The working of your digestive system is based on two things:

The physical (or mechanical) breakdown of the food:

The food you eat is physically broken down into smaller pieces

The chemical breakdown of the food: The large insoluble food molecules must be broken down by hydrolysis reactions into small, soluble molecules so they can be absorbed into your body.

Brain storming question .1. Describe the following words briefly

- i. Ingestion
- ii. Digestion
- iii. Absorption
- iv. Assimilation
- v. Defecation

Moving the food on gut

The breaking down of your food into smaller pieces by the chewing of your teeth isn't the only part of digestion that takes place in your mouth.

Your food is also coated in saliva from the salivary glands.

Saliva contains a carbohydrase enzyme called **amylase**.

Carbohydrases break down carbohydrates.

The **amylase** in your saliva begins the digestion of the starch in complex carbohydrates such as bread or potatoes, turning it into simpler sugars.

The saliva coated chunk of food (known as a **bolus**) moves to the back of your throat to be swallowed. **Swallowing** is a **reflex** action that takes place when food reaches the back of your throat.

As you swallow, your epiglottis closes over the trachea, preventing food going down into your lungs; you can't swallow and breathe in at the same time. If you try to, you will choke and your body will produce violent coughing and heaving movements to make sure the food doesn't get down into your lungs, where it can cause serious problems.

When your food is swallowed it travels down the **oesophagus** or gullet, squeezed along by muscular contractions known as **peristalsis**.

As a result you can eat at any angle you like – even standing on your head – because food does not rely on gravity to arrive in your stomach. Peristalsis is not confined to your oesophagus – it is important all the way through your gut to move the food through as it is digested, to mix the food with the digestive enzymes produced in the various parts of the gut and to continue the physical break-up of the food.

Stomach churning activity

At the lower end of the oesophagus your food passes through a ring of muscle called a **sphincter** into your **stomach**. This sphincter is usually closed except when you are swallowing food, or being sick. The stomach is a muscular bag that produces protease enzymes to digest protein.

The main protease made in the stomach is **pepsin**. The stomach also produces a relatively concentrated solution of **hydrochloric acid**. This acid kills most of the bacteria that are taken in with our food.

After a time – usually between one and four hours – a paste of partly digested food is squeezed out of the stomach through another sphincter into the first part of the small intestine known as the duodenum

Bile

- It neutralizes the acid from the stomach and makes the semi digested food alkaline. This is ideal for the enzymes in the small intestine, which work most effectively in an alkaline environment.
- Bile also **emulsifies** the fats in your food – it breaks down large drops of fat into smaller droplets.

This provides a much bigger surface area of fats for the **lipase** enzymes to work on to break down the fats completely into fatty acids and glycerol

The rest of the small intestine is a long (6–8 m) coiled tube that produces carbohydrase, protease and lipase enzymes of its own. The tube is coiled up to fit inside the body cavity. Your food, which is rapidly becoming completely digested in the alkaline environment, is moved along by peristalsis.

Throughout the small intestine enzymes speed up the breakdown of large molecules into smaller molecules

Once the food molecules have been digested, giving glucose, amino acids, fatty acids and glycerol, they are absorbed by your body (**absorption**). They leave the small intestine by diffusion and go into the blood supply to be carried around the body to the cells that need them. The lining of the small intestine is specially adapted to allow as much diffusion as possible and as rapidly as possible. It has many finger-like projections of the lining (called **villi**) to increase the surface area for diffusion, and each individual villus in turn is covered in even smaller projections called microvilli.

The villi also have a rich blood supply that carries away the digested food molecules and maintains a steep diffusion gradient. The diffusion distances are very small, and the whole process takes place in a water-based solution

Once the digested food molecules have all been taken into the blood they are taken in the **hepatic portal vein** to the liver, which processes some of the food

. The remaining products of digestion are carried around the body to the cells where they are needed. They are built up into the molecules required by the cells. This is known as **assimilation**.

The end of the story

After the digested food molecules have been absorbed into the blood, a watery mixture of enzymes, undigested food (mainly cellulose), bile pigments, dead cells and mucus is left in the small intestine and is moved along by muscle contractions into the large intestine. In this wide, thin-walled tube water is absorbed back into bloodstream by diffusion. By the end of the large intestine the thick paste that remains is known as the faeces. The journey ends as the faeces leave the body through the rectum and the anus as a result of a final set of muscle contractions. This removal of the faeces from your body is called **egestion**.

Questions

1. List the types and function of each enzymes
 - i. In the mouth
 - ii. Stomach
 - iii. Small intestine
3. Identify the enzymes responsible for the conversion of starch to glucose (2016)
4. Describe the function of small intestine in digestive system (2017)
5. Write the correct path way of digestion in our alimentary canal (2017)

Lesson 4 (2hrs)

2.3 The Respiratory System

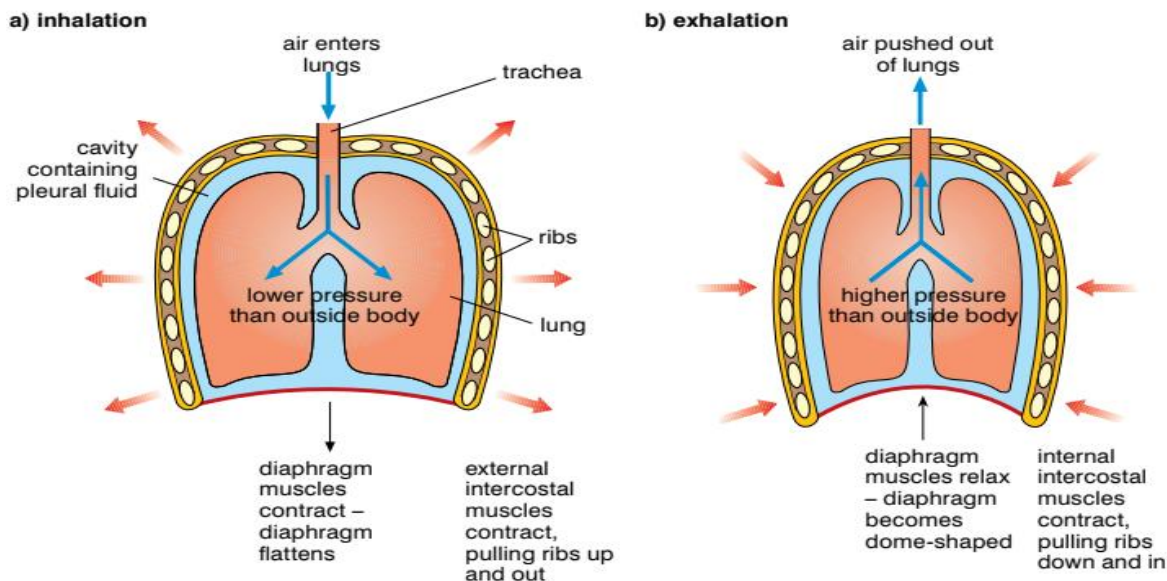
Brain storming question 1. Explain the respiratory system briefly

Respiratory system is network of organs and tissue including the nose, mouth , lungs and diaphragm that facilitate breathing by taking in oxygen and expelling carbon dioxide

- Your nose contains the nasal passages, which have a large surface area, a good blood supply, lots of hairs and a lining that secretes mucus
- The hairs and mucus filter out much of the dust and small particles such as bacteria and pollen that we breathe in, whilst moist surfaces increase the humidity of the air we breathe into our bodies and the rich blood supply warms it
- As air moves down into the **trachea** it passes the oesophagus – the entrance to your gut.
- At the top of your trachea sits your **larynx** or voice box. By directing air leaving the lungs over the vocal cords (flaps of muscle) in the larynx, you produce the sounds that you use in speech.
- The trachea itself has a series of incomplete rings of **cartilage** (shaped like the letter C) that support it and hold it open.

- They are incomplete so that you can swallow your food. Your oesophagus and trachea run next to each other so as a lump (bolus) of food moves down your oesophagus it presses against your trachea.
- If the trachea had solid cartilage rings this would be very uncomfortable. But the open part of the ring faces the oesophagus so the food passes by with no problems
- The trachea splits into two tubes; the left and right **bronchi** (singular **bronchus**), one leading to each lung. The bronchi are also supported by rings of cartilage. Inside your lungs, the bronchi divide into smaller tubes known as the **bronchioles**.
- The bronchioles are much smaller than the bronchi, dividing into ever smaller tubes until they reach the main structures of the lungs – the **alveoli** (singular **alveolus**). There are millions of these tiny air sacs, giving a massive surface area for the main exchange of gases in the lungs to take place

Main differences between inhalation and exhalation



- Questions**
1. Assume you are trying to demonstrate breathing movement using artificial lungs . you pulled down the rubber sheet .This action of pulling represents which step of the actual breathing process? (2014)
 2. During gas exchange between alveoli and blood capillaries oxygen is absorbed by the blood while carbon dioxide is removed this opposite direction of gas exchange occur due to.... (2014)

3. Identify the correct statement about the effect of exercise on breathing rate (2014)
4. Compared to the inhaled air what are the percentage of nitrogen, oxygen and carbon dioxide gases in exhaled air, respectively (2017)
5. Write the structures of respiratory system with their functions (2016)

2.4. The Circulatory System

At the end of this section you should be able to:

- Explain how oxygen and nutrients are transported in the blood.
- Explain the functions of the structures of the heart
- .Indicate the compatibility of the four blood groups.

Brain storming question 1. Define circulatory system

2. What are the components of circulatory system?

Circulatory system is net work of the heart , blood vessels and blood that transport oxygen nutrient and hormones to the body's cells while also removing waste products like carbon dioxide

The human transport system is the **blood circulation system**. It has three elements – the pipes (**blood vessels**), the pump (the **heart**) and the medium (the **blood**). All mammals have a similar system.

Double circulation

Two transport systems within the body carrying blood from the heart to the lungs and back again; and all around the body and back again

Pulmonary circulation blood flows from the heart to the lungs and back again

Systemic circulation blood is pumped from the heart, all around the body and back again

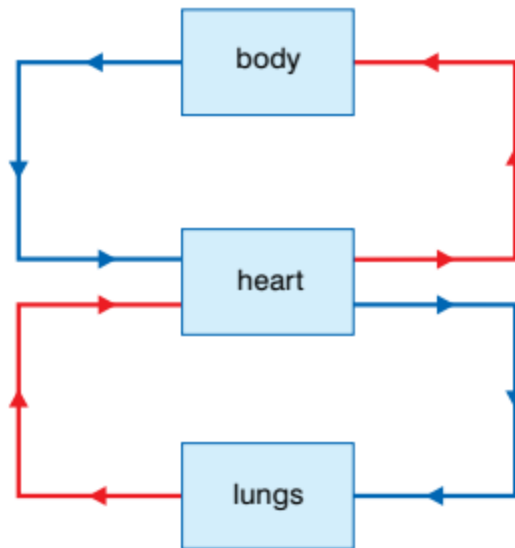
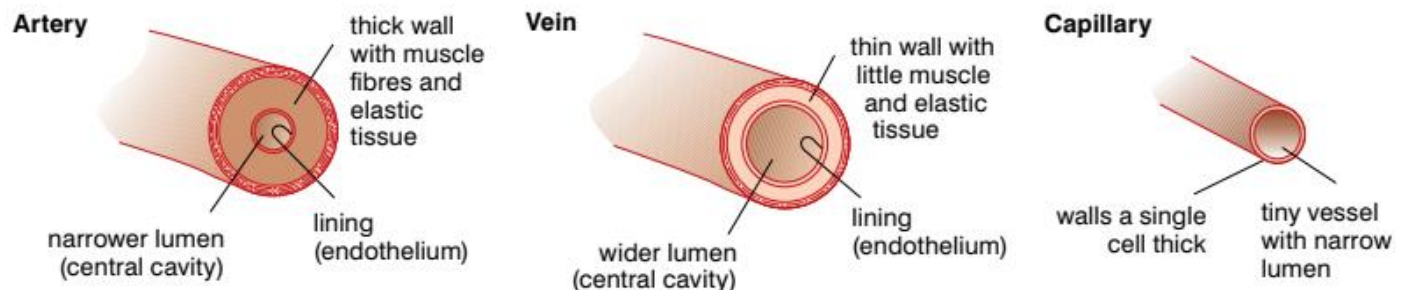


Figure 3.47 The two separate circulation systems supply the lungs and the rest of the body.

The blood vessels

A very important element of any transport system is the pathways along which the transport takes place.

In the human body we have three main types of blood vessels, arteries, veins and capillaries



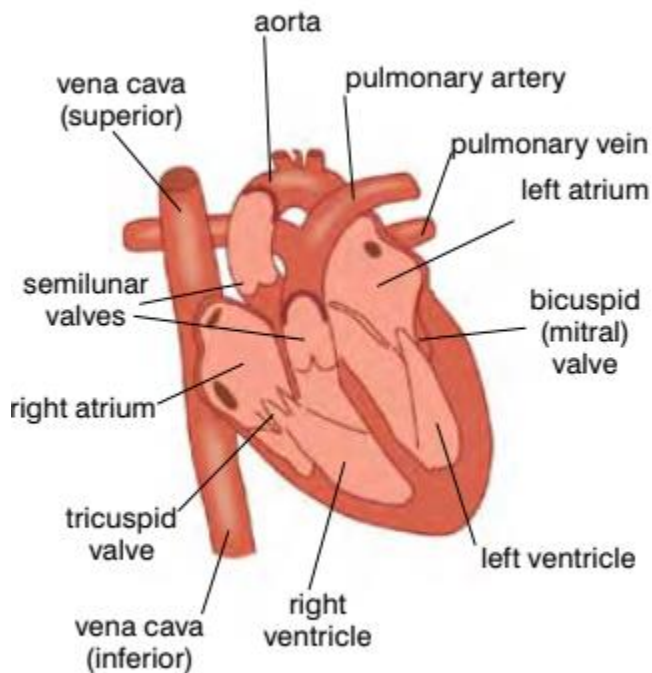
Question 1 list the differences among blood vessels

2. Explain function of each blood vessel
3. Explain the functions of the structures of the heart..

The human heart

- The human heart is a bag of reddish-brown muscle that beats right from the early days of our development in the uterus until the end of our life, sending blood around the body. The heart is made up of two pumps that beat at the same time so that blood can be delivered to the body about 70 times each minute.

- The heart is made up of a unique type of muscle known as **cardiac muscle**, which can contract and relax more or less continuously without fatiguing. The walls of the heart are almost entirely muscle.
- These muscular walls are supplied with blood by the **coronary arteries**, so that they have a constant supply of glucose and oxygen and the carbon dioxide produced is not allowed to build up in the tissue



b) Vertical section through the heart

The working of the heart

The two sides of the heart fill and empty at the same time to give a strong, co-ordinate beat, but to understand what happens it is easier to follow a single volume of blood around the heart.

- Deoxygenated blood, which has supplied oxygen to the cells of the body and is loaded with carbon dioxide, comes into the right atrium of the heart from the veins of the body.
- The atrium contracts and forces blood into the right ventricle.
- The right ventricle contracts and forces blood out of the heart and into the lungs where it is oxygenated – it picks up oxygen.
- Oxygenated blood returns to the left-hand side of the heart from the lungs and the left atrium fills up.

- The left atrium contracts forcing blood into the left ventricle.
- The left ventricle contracts forcing oxygenated blood out of the heart and around the body.

Inside the heart there are many different **valves**. Their names describe their appearance – bicuspid (two parts) tricuspid (three parts) and semi lunar (half-moon).

Each time the muscular walls of the heart contract and force blood out, some of these valves open to allow the blood to flow in the right direction, and other valves close to make sure that the blood does not flow backwards. The noise of the heartbeat we can hear through a stethoscope is actually the sound of these valves transporting the surging blood.

Questions 1. Write the part of the heart with their correct function (2016)

2. Write blood vessels with their correct function (2016)

3. How does oxygen is transported in human body (2016)

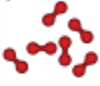
4. Why the left ventricles is tough in nature(2016)

5. Contraction of left ventricles forces blood in to (2017)

Human blood groups

A number of special proteins called **antigens** are found on the surface of all cells. They allow cells to recognize each other and also to recognize cells from different organisms.

If the cells of your immune system recognize a foreign antigen on a cell in your body, they will produce **antibodies**

Recipient Donor	O (antibodies a and b)	A (antigen A, antibody b)	B (antigen B, antibody a)	AB (antigens A and B)
O (antibodies a and b)	✓ 	✓ 	✓ 	✓ 
A (antigen A, antibody b)	✗ 	✓ 	✗ 	✓ 
B (antigen B, antibody a)	✗ 	✗ 	✓ 	✓ 
AB (antigens A and B)	✗ 	✗ 	✗ 	✓ 

This diagram shows you the compatibility of the different blood groups

Question

1. Assume you wanted to demonstrate compatibility of blood groups you took four test tubes labeled O, A, B and AB on the blood group that each test tube contains . Then you added unknown blood sample in to each test tube and no agglutination was observed in each test tube from this you can conclude that the unknown blood sample was...(2014)
2. In the context of ABO blood groups transfusion of AB blood may be given to person who has blood type
3. Assume that woman with out antigens in the blood cells , losses a lot of blood when giving birth in hospital the compatible donor for this woman is ...(2017)

.....THE END.....