Longley Park Sixth Form Transition Pack

Biology (A Level and Applied Science)

Biology (A Level and Applied Science) Preparation Booklet 2021

This booklet contains a series of activities to help support you with the transition from GCSE to Sixth Form.

These key topics cover some of the foundations of biology that should be familiar to you during your studies so far. Make sure you attempt all activities to the best of your ability.

This booklet includes:

Cell structure
Microscopy
Osmosis
Structure of DNA
Cell division
Heart structure
Respiration
Photosynthesis

1. Cell Structure

Cell Structure

There are two types of cells, they can either be prokaryotic or eukaryotic. Eukaryotic tend to be more complex but prokaryotic are smaller and much simpler

Prokaryotic

Here is an example of a prokaryotic cell. It is a single celled organism

Eukaryotic

Here is an example of a Eukaryotic cell which tends to be more specialised and contain more organelles

Animal cells

Most animal cells have various subcellular organelles

Nucleus- Contains DNA and controls the cell

Cytoplasm-Where chemical reaction occur.

Cell Membrane-Hold the cell together

Mitochondria-Where aerobic respiration occurs

Ribosomes-Protein synthesis

Plant cells

Plant cells have all the same subcellular structure as an animal cell however it has a few extra

Cell Wall-Made of cellulose and support the cell

Permanent Vacuole-Contains cell sap

Chloroplasts-Site of photosynthesis

Chlorophyll- Absorbs light and is found within chloroplasts

In the tables below:

1) Tick if the organelle is present
2) 2) Describe the function of the organelle

Organelle	**Eukaryotic**		Prokaryotic
	Animal	**Plant**	Bacteria
Nucleus			
Cytoplasm			
Cell Membrane			
Ribosomes			
Mitochondria			
Cell Wall			
Chloroplast			
Permanent vacuole			
Other information			

Organelle	Function
Nucleus	
Cytoplasm	
Cell Membrane	
Ribosomes	
Mitochondria	
Cell Wall	
Chloroplast	

Permanent vacuole	

Microscopy

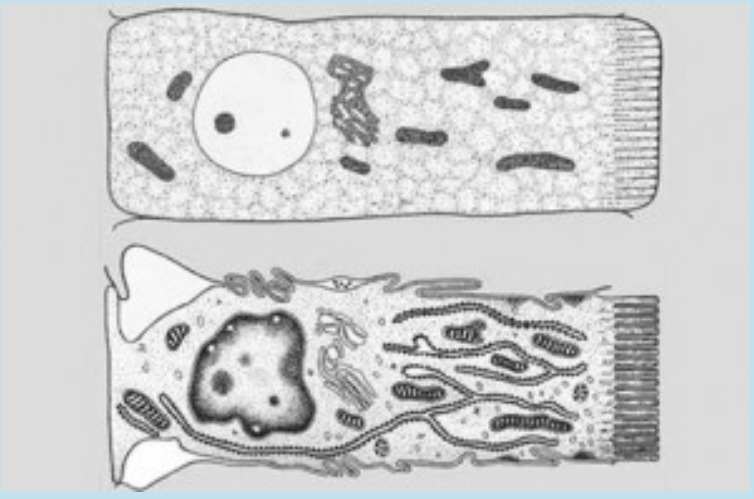
Microscopes are instruments that allow scientists to see things that are too small to be seen with the naked eye, such as cells. Animal cells are usually around 10 – 30μm long. In contrast, prokaryotic cells (bacteria) are 1 or 2 order of magnitudes smaller (10 or 100 times smaller) with a length of approximately 0.2 – 2μm.

Prefix	Metre	Metres power	Equivalents
kilo-	km	10^3	1km = 1000m
-	m	10^0	=1m
centi-	cm	10^{-2}	1m = 100cm
milli-	mm	10^{-3}	1 mm = 1000μm
micro-	μm	10^{-6}	1cm = 10 mm
nano-	nm	10^{-9}	10μm = 1000 nm

The light microscope was developed in the mid 17th century and uses lenses and visible light to magnify biological samples such as cells. You can see the structure of cells because a light microscope can **magnify** up to 2,000 times the real size. This means the image you see makes the cell appear up to 2,000 times bigger. The image is also clear: the resolution is high enough to distinguish the nucleus from the mitochondria for example. The resolving power of a microscope is the ability to see two things as separate. The most powerful light microscope's resolving power is 200nm, which means you can clearly see the difference between two things that are 200nm apart.

Electron microscopes were developed in the 1930s, and they use a beam of electrons instead of light. They can magnify up to 2,000,000 times and have a resolving power of 0.2nm! Electron microscopes helped us to see smaller organelles such as ribosomes; something the light microscope cannot show us. It also shows us the details of organelles like mitochondria. This helped further our understanding of sub-cellular structures. However, electrons microscopes are much more expensive than light microscopes.

Task: Use the information above and the image below to compare the light & electron microscopes:



Light Microscope	Electron Microscope

Converting Units

An average eukaryotic cell is 50 µm.

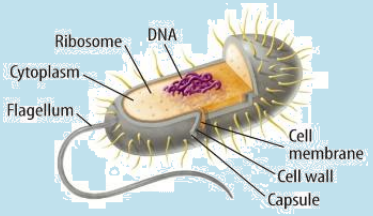
How many micrometres in one millimetre?

What is the length of two eukaryotic cell side by side?

How many eukaryotic cells do you need to put side by side to make 1000 µm?

How many eukaryotic cells do you need to put side by side to make 1mm?

How many millimetres is 50 µm? (This question is asking you to convert 50µm into mm).



An average prokaryotic cell is 5 µm.

How many nanometres in one micrometre?

What is the length of two prokaryotic cells side by side?

How many prokaryotic cells do you need to put side by side to make 1000 µm?

How many prokaryotic cells do you need to put side by side to make 1mm?

How many millimetres is 5 µm? (This question is asking you to convert 5µm into mm).

Mystery cell ?

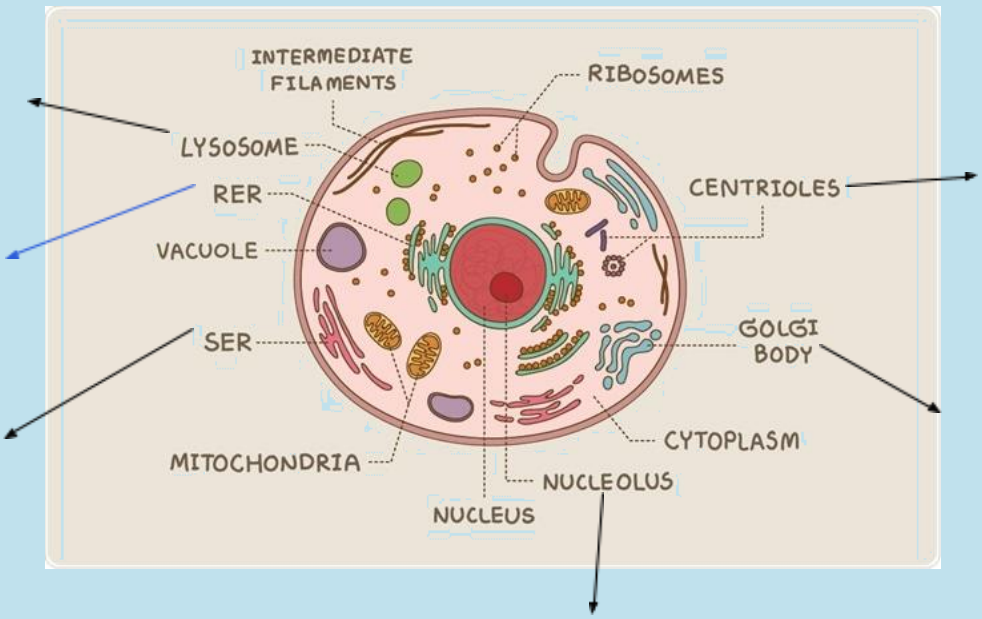
At A level you need to know the jobs of more organelles. Do some research and write the jobs of the organelles below next to the arrows:

A mystery cell is 7500 nanometres.

How big is this in micr

Animal Cell

Do you think this cell is a eukaryotic or a prokaryotic cell? Explain your



3) Osmosis

Osmosis is a key principle which you will need to understand and apply in both AS and A level biology. It is needed to explain formation of urine in the kidney; transport in plants; homeostasis and many other topics.

Watch the video below and answer the questions on the next page.

Amoeba sisters video on osmosis:

https://www.youtube.com/watch?v=L-osEc07vMs

Answer the following questions as you listen to the osmosis video;

1. What is osmosis?

2. What type of transport is osmosis?

3. What are solutes?

4. If you have pure water on both sides of a semi-permeable membrane, in which direction would the water move?

5. What does hypertonic mean?

6. In osmosis, water moves from the h…….. side to the h…….. side.

7. If you ran pure water in an IV drip what would happen?

8. What is the word that means equal concentrations of solute on each side?

9. How does water get into plant roots?

4) Cell Division – Mitosis & Meiosis

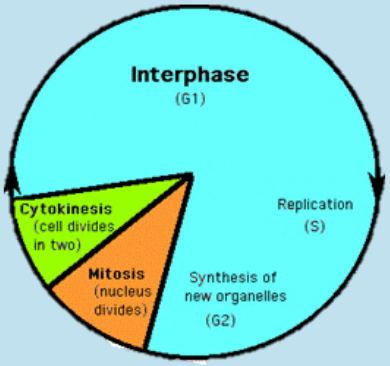
1. Interphase

The r_____ p_____. The number of sub-cellular structures, e.g. mitochondria and ribosomes i_____.

The DNA r_____ to form t_____ copies of each c_____.

Further growth occurs and the DNA is checked for any m_____ made.

Cell Cycle



2. Mitosis

The c_____ move apart and n_____ m_____ form.

3. Cytokinesis

The c_____ s_____ into two and the new d_____ c_____ separate to give two new g_____ i_____cells

Use the following key words to complete the following paragraph describing mitosis:

chromosome, genes, daughter, nucleus, clone, DNA, genetic, growth, migrates, replicates, two

Inside the _____ of all cells are a set of chromosomes made of _____ which carries the _____. Each _____ makes a copy of itself. This is to ensure that each new cell has identical _____material. Each copy of a chromosome _____ to the opposite end of the cell. The cytoplasm also _____. This ensures each new cell has all the materials it needs in order to carry out its reactions. The cell divides into _____. Each cell has the same number of chromosomes as the original cell and is an exact genetic copy or _____. These are _____cells. They are exact copies so they can carry out the same work as the original cell. Mitosis is used for _____ and repair.

The table below shows the life spans of different cells.

Draw a graph of the data in the table below, choosing a suitable scale.

Name of human cell	Life span (days)
Red blood cell	120
Cells of stomach lining	5
Cells on surface of skin	14
Liver cells	300
Sperm cell	5
Egg cell	1

1) Which cells have the shortest life span?

2) Which cells have the longest life span?

3) Is there any connection between cell type and lifespan?

A	Each of the four daughter cells (egg or sperm) has half the number of chromosomes
B	Each chromosome copies its DNA, this new strand of DNA remains attached to the first
C	Parent cell in testes or ovary undergo interphase

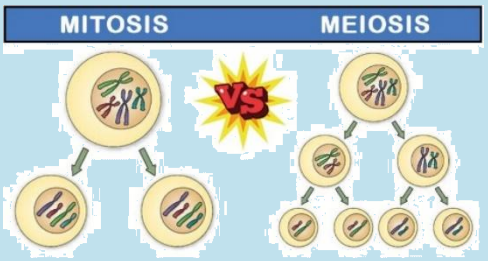
D	Homologous chromosomes are pulled apart and the cell divides once
E	The sister chromatids are pulled apart and the cell divides a second time.
F	The two attached strands of DNA are known as sister chromatids

MEIOSIS

Put the following statements in the correct order so that they describe the process of meiosis.

Answer:

_____



Complete the following table:

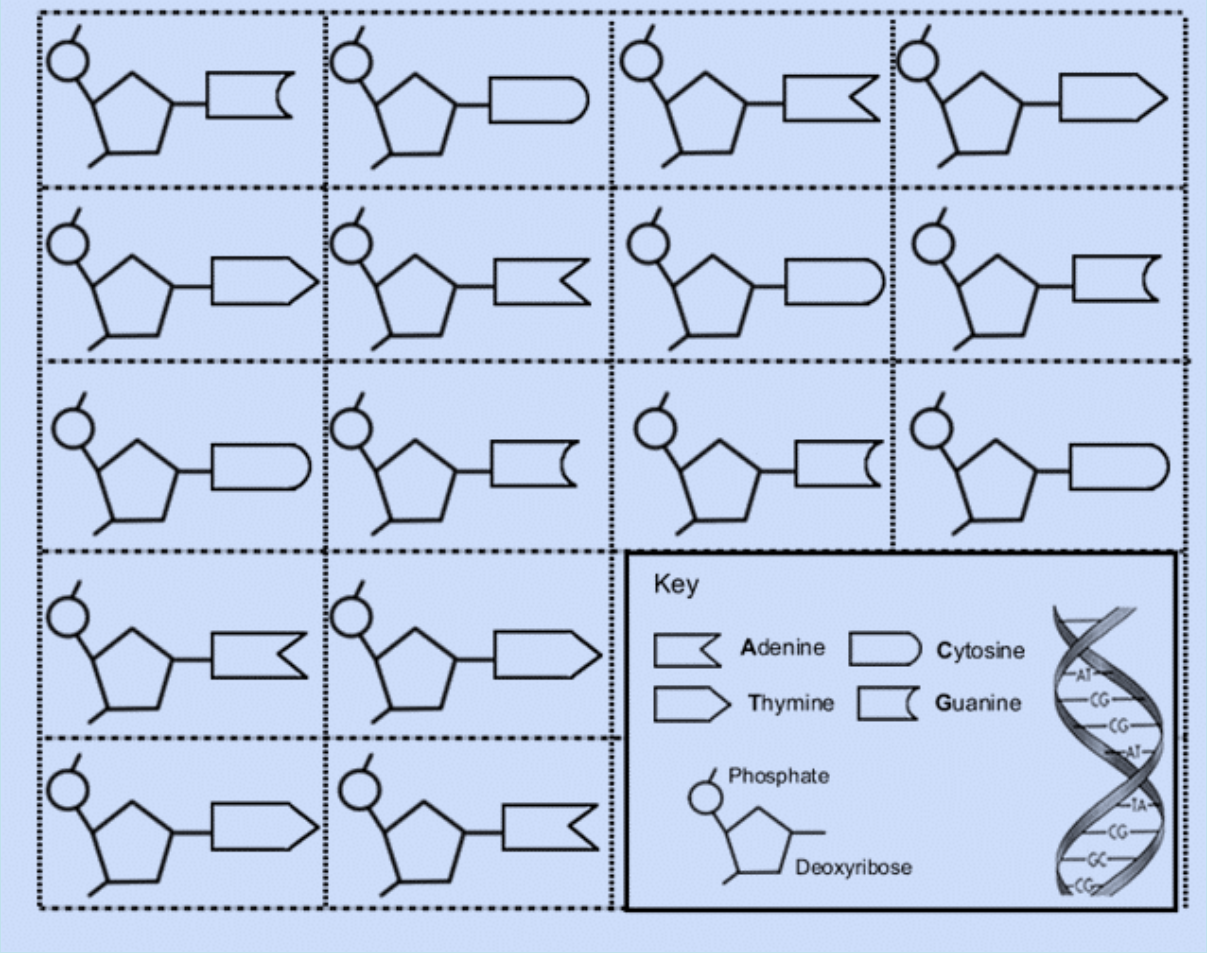
	Meiosis	**Mitosis**
What is it used for?		
Type of reproduction		
Number of chromosomes after cell division		
Number of daughter cells produced		
Number of cell divisions		
Causes variation?		

5) Structure of DNA

Structure of DNA – cut and stick activity

Longley Park
SIXTH FORM

longleypark.ac.uk

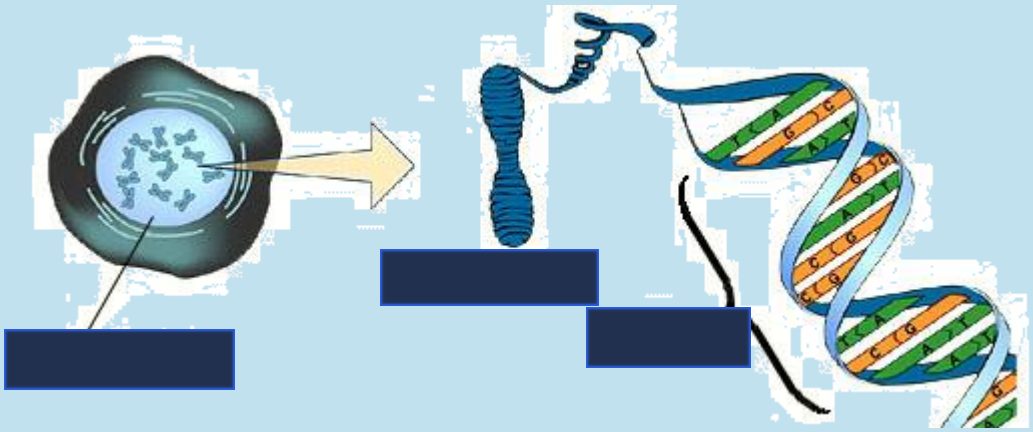


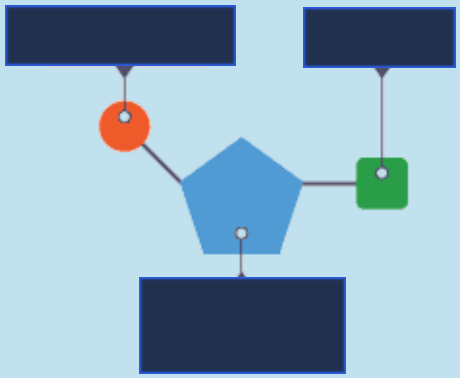
1. Cut out each of the nucleotides and arrange them on the grid. Remember the **Base-Pair Rule (A-T, G-C)**. (You will have one set left over). Separate paper may also be used.
2. To match the pairs, one of the nucleotides must be arranged upside down. The sides of the DNA double helix are arranged in an **anti-parallel** fashion. Think of them like lanes on a highway going different directions.
3. Colour each of the nucleotides:

   Thymine=orange, Adenine= green, Guanine=purple,

   Cytosine= yellow, Deoxyribose sugar= blue, Phosphate= pink

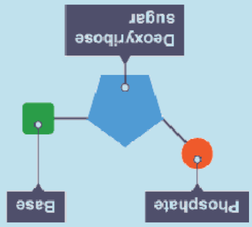
1. Label the diagrams.

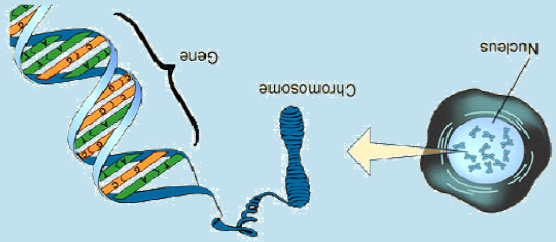




The basic units of DNA are called _____.

Answers





Structure of DNA

_________ has a structure like a twisted ladder. The structure is called _________________________.

DNA has ______________________. Each strand is made of units called ______________________ joined together.

Each unit contains three parts:

____.

There are ________ different bases each represented by the letters ______________________.

The two strands are complementary with _____ linked _____ and ______ linked to _______.

As there are many units, the whole structure is called a _________________.

A sequence of three bases is the genetic code for a particular ________________.

The order of bases controls the order in which ________________ are assembled to produce a particular ______________.

When the __________ chain is complete it folds up to form a ____________________.

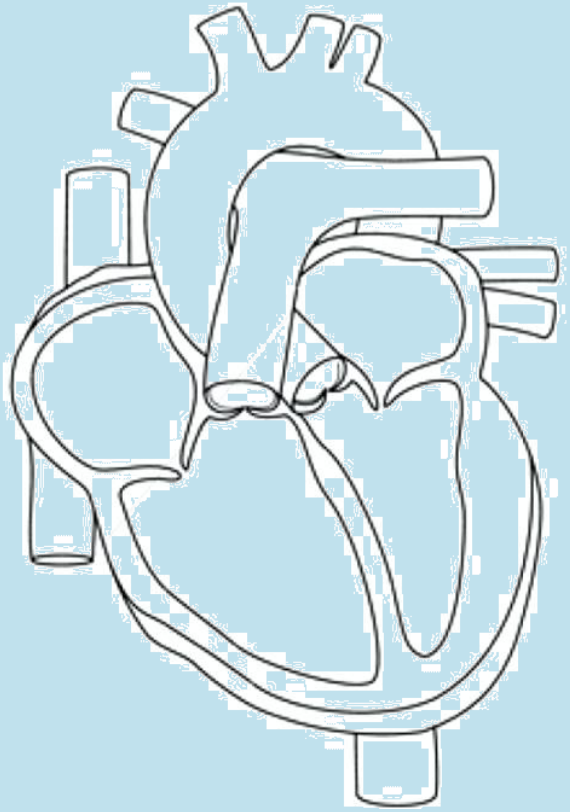
__________________ occur continuously.

A few ________________ code for an altered ________________ with a different ______________.

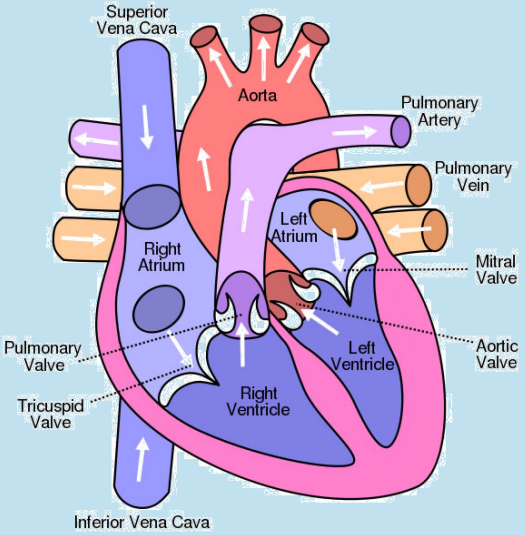
protein, bases, four, amino acids, C, unique shape, two strands, mutations, protein, sugar molecule, DNA, mutations, GACT, A, protein, phosphate group, shape, double helix, T, polymer, G, amino acid, nucleotides.

6) Heart Structure

https://www.bbc.co.uk/teach/class-clips-video/science-biology-ks3-ks4-gcse-the-human-heart/zr47nrd



Colouring activity – follow the instructions below to show the different parts of the heart using different colours.



1. Colour the bicuspid valves yellow.
2. Colour the right atrium light blue.
3. Colour the interior surface of the left ventricle red.
4. Colour the semilunar valves light green.
5. Colour the exterior of the inferior vena cava dark green.
6. Colour the exterior of the aorta brown.

7. Draw a black arrow to show the path of blood in via the vena cava and out via the pulmonary artery.

8. Colour the septum orange.

9. Draw dark blue arrows to show the direction of blood flow in the 4 pulmonary veins.

10. Draw a purple arrow to represent blood flow to the left lung.

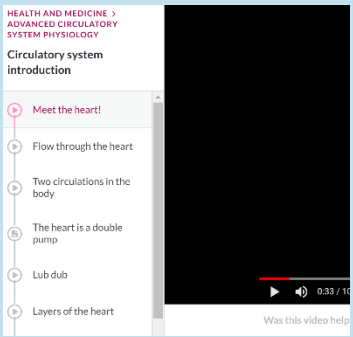
Now list the order of the parts (chambers of the heart and blood vessels) that blood flows through in one circulation of the body starting at the vena cava:

Vena cava _____ _____ _____ Lungs _____ _____ _____ Body cells

Structure and function of the heart and circulation

Go to the following website.

https://www.khanacademy.org/science/health-and-medicine/circulatory-system/circulatory-system-introduction/v/meet-the-heart



Watch "Meet the heart", "Flow through the heart" and the first 5 mins and 30 seconds of "Layers of the Heart".

You might also find the information page "The heart is a double pump" useful.

Meet the heart

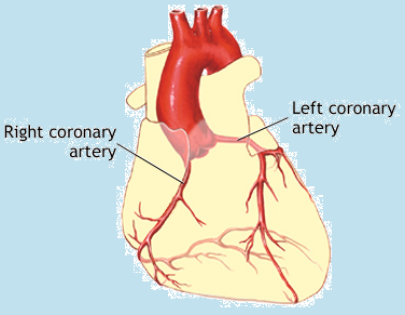
1. Describe the location of the heart.

2. Explain why every cell in the body needs to be near a blood vessel.

3. Name the two veins that transport blood back to the heart.

4. Name the main artery transporting blood away from the heart.

5. Describe what is meant by pulmonary blood flow.



6. Describe the role of the coronary vessels.

https://www.bbc.co.uk/teach/class-clips-video/science-biology-ks3-ks4-human-circulation/zfbd6v4

7) Respiration

Respiration is not breathing….so what is it?
https://www.bbc.co.uk/teach/class-clips-video/biology-ks3-gcse-aerobic-respiration/zmncqp3

_____

_____

_____

State the purpose of respiration and describe it using the word equation for aerobic respiration.

Complete the word equation for aerobic respiration:

..... + ... → ..... + ... + ...

Where does respiration occur in organisms? Explain why this is important.

.....

.....

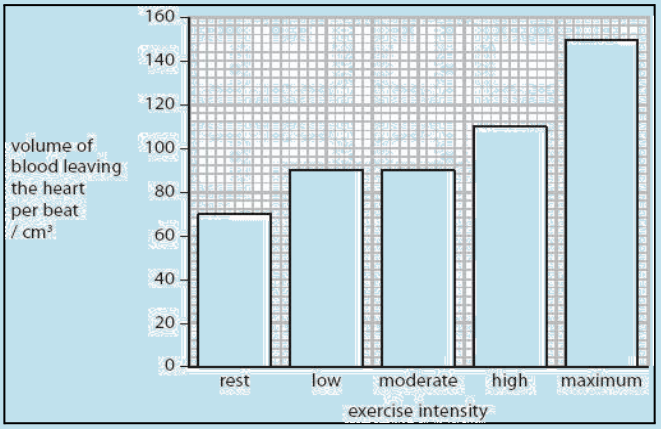
Describe anaerobic respiration using a word equation.

The **substance** produced during anaerobic respiration is:

A glucose
B lactic acid
C oxygen
D water

Complete the word equation for anaerobic respiration:

.... + ...



The graph above shows the effect of exercise intensity on the volume of blood leaving the heart per beat. The difference between the volume of blood leaving the heart at rest and the volume of blood leaving the heart at maximum exercise intensity is:

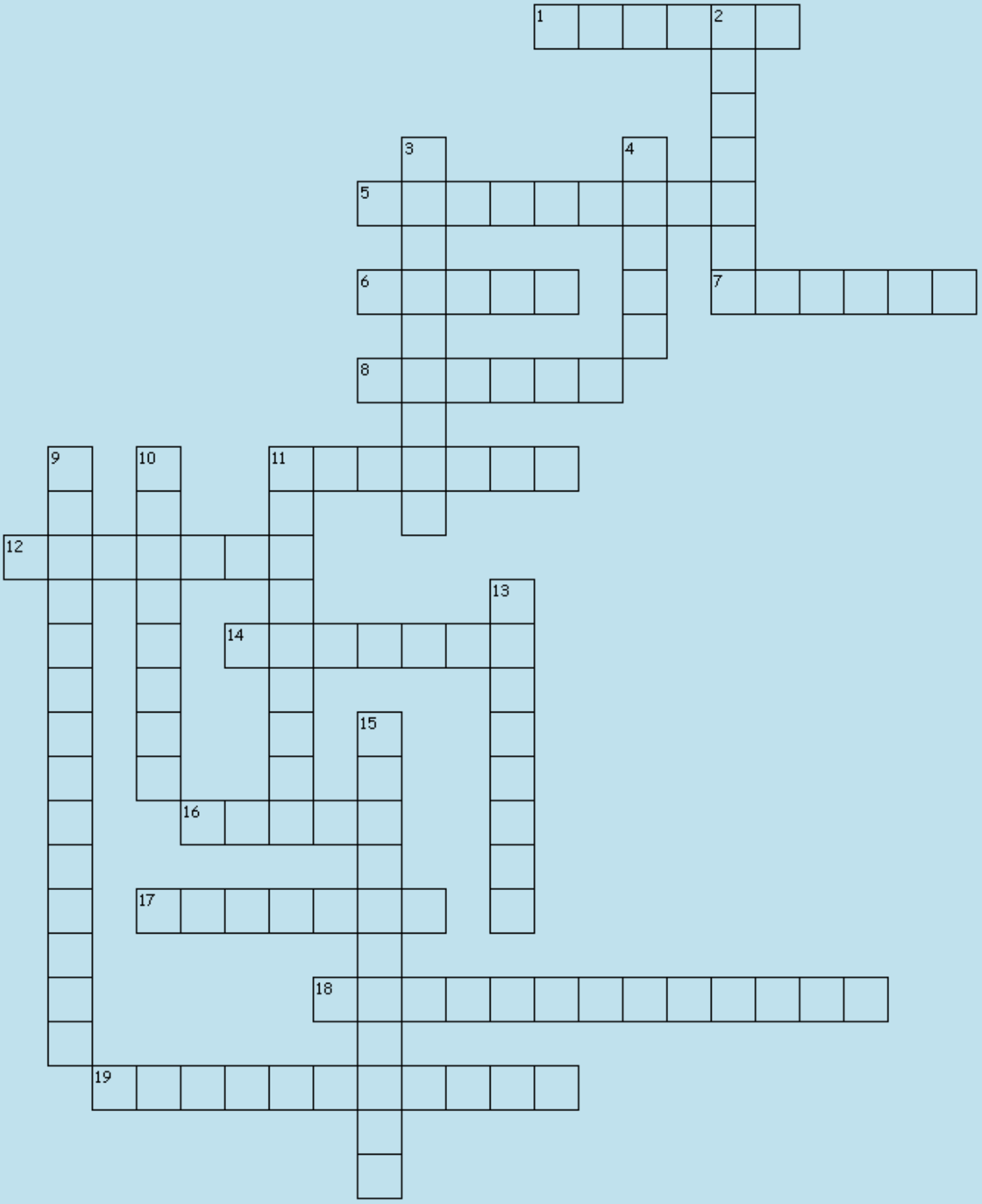
A 70 cm^3
B 80 cm^3
C 90 cm^3
D 150 cm^3

Using information in the graph, describe the effect of different levels of exercise intensity on the volume of blood leaving the heart.

.....

.....

RESPIRATION AND GAS EXCHANGE



Across

1. Gas needed for aerobic respiration.
5. Oxygen moves from the lungs into capillaries by this process.
6. Algae used in bread-making.
7. Another name for the voice box.
8. Anaerobic respiration in muscles produces this acid.
11. Small sac-like structures where gas exchange occurs.
12. Tube which connects the mouth and nose to the lungs.
14. The trachea breaks up into these smaller tubes to enter the right and left lungs.
16. Traps dust and microbes that enters the airways.
17. Respiration in the presence of oxygen.
18. Gas produced in both aerobic & anaerobic respiration (two words).
19. Within the lungs the bronchi split into these even smaller tubes which attach to the alveoli.

Down

2. The alcohol produced during anaerobic respiration of yeast.
3. Chemical used to test for carbon dioxide.
4. Tiny hairs on the cells that line the trachea - sweep any unwanted microbes or particles out of our lungs and airways.
9. A poisonous gas found in tobacco smoke which combines with haemoglobin in red blood cells (two words).
10. Addictive chemical found in tobacco smoke.
11. Respiration in the absence of oxygen.
13. Makes up 79% of inspired air.
15. A chemical reaction that breaks down nutrient molecules in living cells to release energy.

Choose from: *Respiration, Aerobic, Anaerobic, Carbondioxide, Oxygen, Lactic, Ethanol, Yeast, Larynx, Trachea,Alveoli, Bronchi, Bronchioles, Limewater, Nitrogen, Diffusion, Carbonmonoxide, Nicotine, Mucus, Cilia*

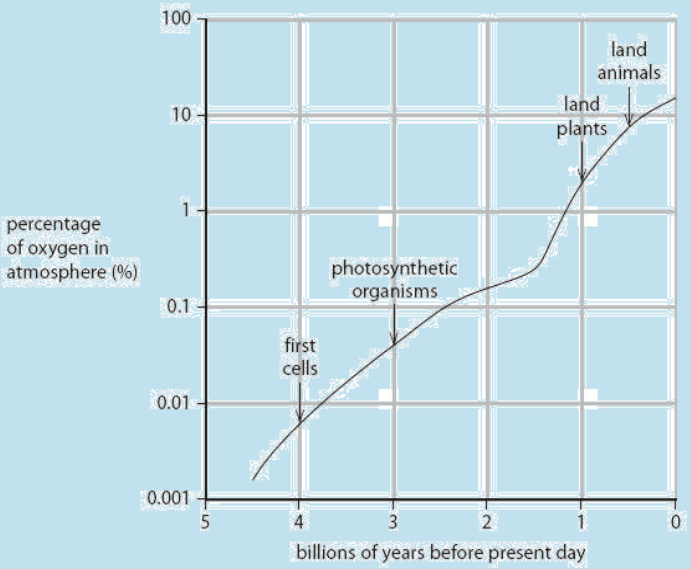
8) Photosynthesis

Describe photosynthesis using a word equation.

..... + ... + ...

This graph suggests that the level of oxygen in the atmosphere was important for the evolution of many living organisms.

.....



How much oxygen was needed in the atmosphere for the evolution of land animals?

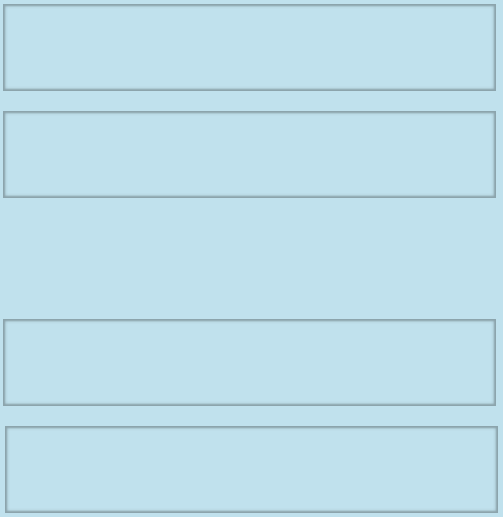
A 0.009%
B 0.09%
C 0.9%
D 9.0%

Suggest how photosynthesis could have changed the gas content of the atmosphere.

.....
.....
.....
.....
.....
.....
.....

Explain how the structure of a leaf is adapted for photosynthesis including ideas about large surface area, chlorophyll in chloroplasts and stomata for gas exchange.

The diagram shows a section through a leaf. Fill in the boxes to identify cell types A-D and the gases moving into and out of the leaf.



Describe the functions of each cell type and explain how each cell type is adapted to performing their function.

Cell A

.....

.....

.....

.....

Cell B

.....

.....

.....

.....

Cell C

.....

.....

.....

.....

Cell D

.....

.....

.....

.....

And to finish a photosynthesis rap…..!

https://www.bbc.co.uk/teach/class-clips-video/biology-ks3-gcse-photosynthesis-rap/zm638xs

9) Enzymes

Enzymes are biological catalysts. This means that they speed up reactions in living organisms by making them easier to happen. Every reaction in your body is controlled by an enzyme, this is why they are so important.

https://www.bbc.co.uk/teach/class-clips-video/biology-ks3-gcse-enzymes-and-active-sites/zd2f47h

Task 1 : Word Match

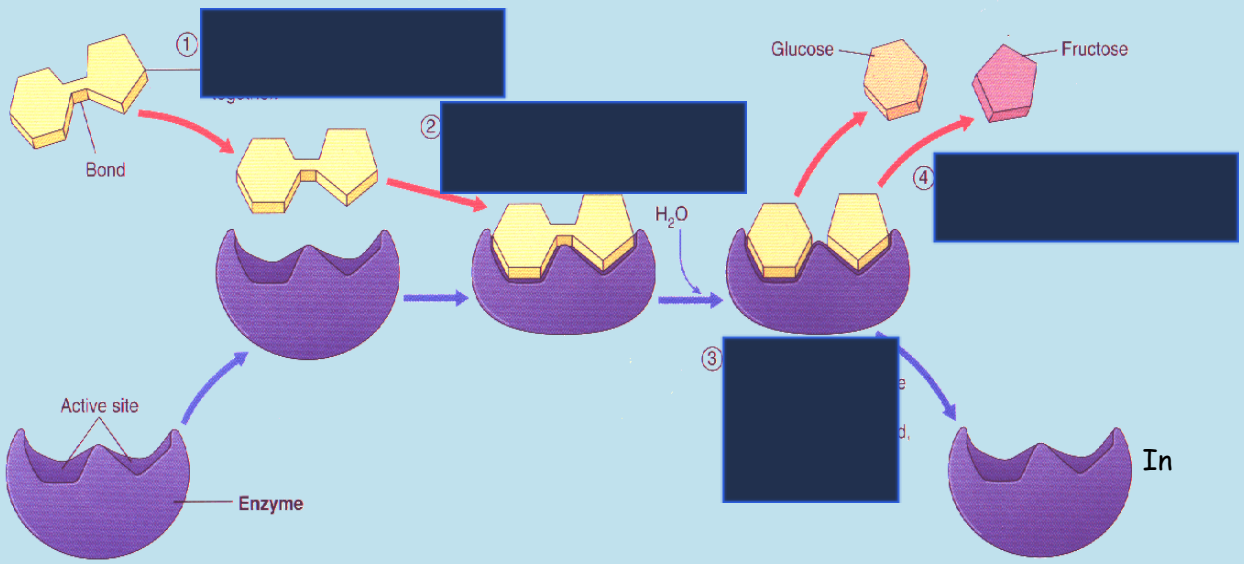
Match the following words to their definition:

1. Product	A. The amount of energy required for a chemical reaction to occur
2. Active Site	B. Substances that bring a chemical reaction without being changed themselves
3. Enzymes	C. Substance that an enzyme acts upon
4. Catalyst	D. Regions on the surface of an enzyme that fits the substrate

5. Substrate E. Substance formed from the substrate at the end of a chemical reaction with an enzyme

6. Activation Energy F. Proteins that speed up the chemical reaction

Task 2 – label the diagram using terms from task 1



your own words explain how the enzyme breaks the bond of the substrate in the above process.

1.

2.

3.

4

And finally

https://app.senecalearning.com/classroom/course/76917ca0-ac10-43c9-8742-e49b861417b2/section/e338b8d5-76ab-4a62-a9f3-a680c8441d9a/session

Here is an interactive website which gives feedback and allows you to develop understanding.

This link should take you to a page with a GCSE refresher task and an A level preparation session.

Good luck!