GCSE 9-1 Biology Revision Topic 8 - Blood, heart, lungs & respiration

Respiration is an _____ reaction, as energy is _____, some is lost as heat (and keeps us warm!). It occurs in every_____ of all living organisms

Equation for aerobic respiration: _____ + _____ → _____ + _____ + _____

What food group do we eat to obtain the glucose?

How does the glucose and oxygen reach the cells?

What happens to the carbon dioxide?

Equation for anaerobic respiration in humans: _____ → _____ + _____

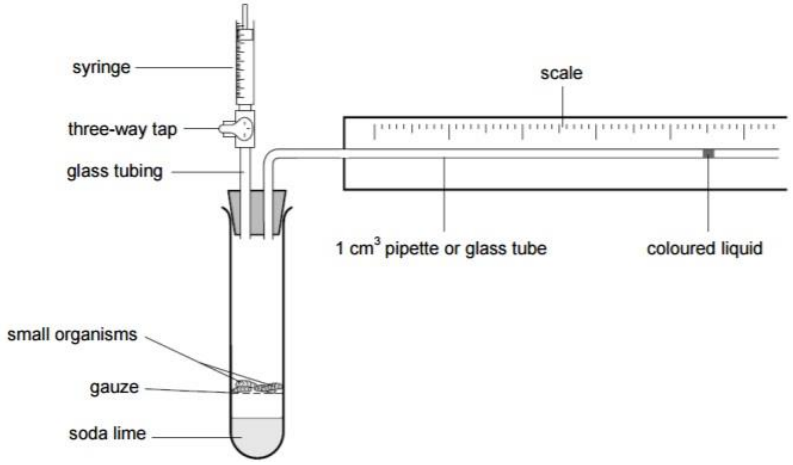
What conditions does anaerobic condition occur in?

Equation for anaerobic respiration in plants: _____ → _____ + _____ + _____

What processes use the energy (ATP) released from the glucose? (include plant and animal processes)

	Aerobic respiration	**Anaerobic respiration in humans**
Where it occurs		
Produces more energy		
Uses oxygen		
Produces carbon dioxide		
Controlled by enzymes		

CORE PRACTICAL – respirometers – how to investigate respiration in small invertebrates



What is the purpose of the soda lime?

Which way will the coloured liquid move and why?

Why should the respirometer be placed in a thermostatically controlled waterbath?

What results will you record?

How many repeats should be done?

What can you then identify in your results?

Complete this table, including appropriate units (respirometer glass tubing circular diameter = 1mm)

Temperature (^oC)	Start position of coloured liquid (mm)	End position of coloured liquid after 5 min (mm)	Distance moved (_____)	Volume of oxygen used (_____)	Rate of respiration (_____ / ____)
20	10	33			
25	12	47			
30	15	57			

What can you conclude about the effect of temperature on rate of respiration?

What type of graph would you draw to present these results?

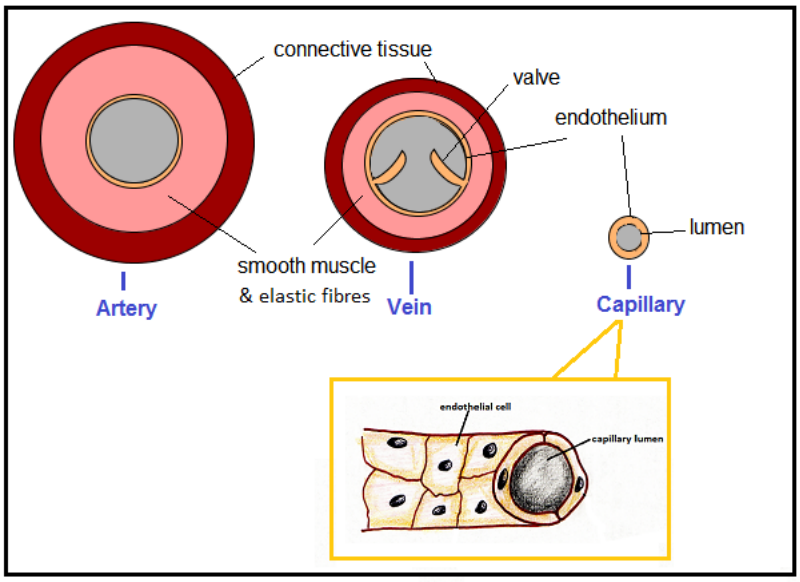
What would go on X axis? Y axis?

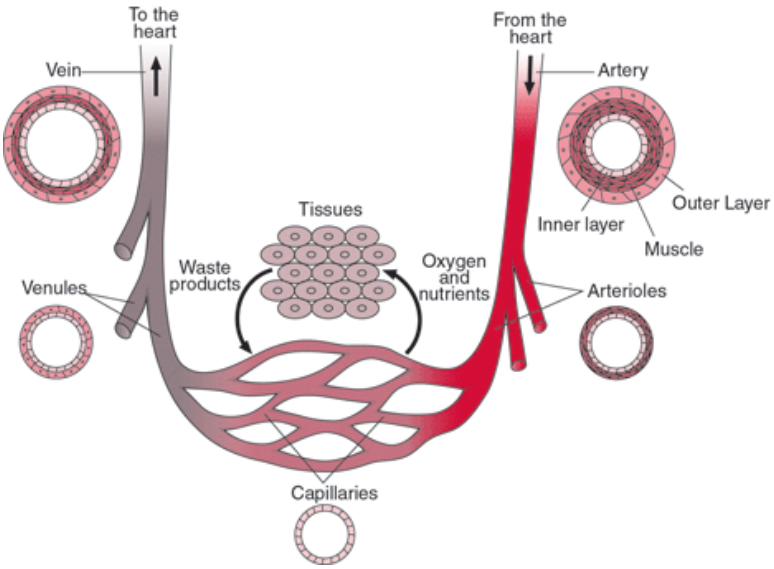
The blood and circulatory system

Match up the cell to function and structure:

Component of blood	**Structure**	**Function**
White blood cells	Liquid part of the blood	Important for blood clotting to reduce blood loss from a cut/wound. The clot prevents entry of _____ that could cause infection.
Platelets	Biconcave increasing the surface _____, no _____, most abundant cell in the blood, live for 120 days, made in bone marrow, contains iron (deficiency = anaemia).	Some produce antibodies (B cells), some do phagocytosis (neutrophils and macrophages) and digest _____.
Plasma	Cell fragments	Haemoglobin in the cell transports O_2 (as oxyhaemoglobin) from _____ to the cells of the body for _____ respiration. O_2 binds and leaves the cell by _____.
Red blood cells	Contain a nucleus, important in immune response against pathogens	This contains soluble nutrients (eg glucose, _____ acids, fatty _____, vitamins), hormones, antibodies, transports urea to the _____ for excretion, and the cells of the blood. Also transports CO_2 back to the _____ for exhaling. Also involved in heart transfer to maintain body temperature (homeostasis) .

Blood vessels – fill in the gaps





Arteries transport _____ blood away from the heart to the tissues, the blood is under _____ pressure , so the walls are _____ and contain _____ and _____fibres.

Arteries branch into thinner _____ and these then branch into _____.

Capillaries are one _____ thick, allowing rapid _____ (movement from high to low concentration) of molecules into the cells and _____ _____ (from respiration) diffuses back into the blood.

Capillaries unite to form _____ and these then join to form _____, taking the deoxygenated blood back to the heart. To prevent backflow of blood in the veins there are _____. The contraction of skeletal _____ around the veins also helps return blood back to the heart

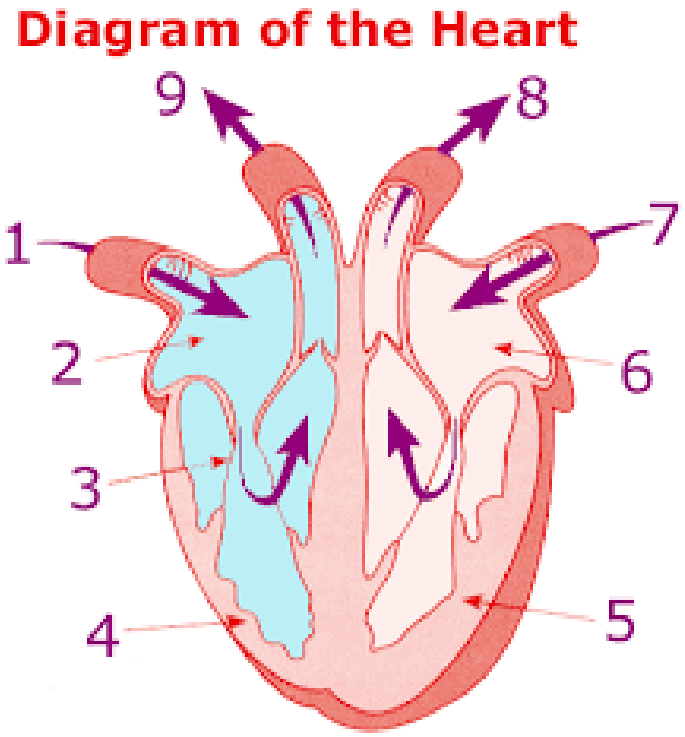
Blood in veins is under _____ pressure, so their walls are _____with less muscle and elastic fibres than arteries

1. Why would a blood sample be taken from a vein and not an artery? [2]

2. What molecules pass out of the capillary by diffusion and enter surrounding cells?

3. What waste products need removing from cells and enter the capillary by diffusion?

The heart



Label 1-9 of the heart using the following labels*: right atrium, left atrium, right ventricle, left ventricle, aorta, vena cava, pulmonary artery, pulmonary vein, valve. Also indicate where the blood has come from and which side is oxygenated and deoxygenated.*

The aorta carries blood from the _____ to the _____

The pulmonary artery carries blood from the _____ to the _____

The _____ _____ carries blood from the lungs to the left atrium

The _____ _____ carries blood from the body to the right atrium

The heart has ____ chambers (left and right ____ and left and right _____). Oxygenated blood from the ____ enters the _____ hand side of the heart via the pulmonary _____. Oxygenated blood leaves the heart in the _____ (the biggest artery of the body). Deoxygenated blood returns to the heart from the body in the _____ _____to the _____ hand side. Deoxygenated blood leaves the heart in the pulmonary _____ to go to the lungs to be oxygenated. Therefore blood passes though the heart _____ in each circulation. To prevent backflow of blood from the ventricles to the _____ there are _____ (bicuspid and tricuspid). These close when there is higher pressure in the ventricles compared to the atria. There are also semi lunar _____ leading out towards the aorta and pulmonary artery to prevent backflow into the _____.

The left ventricle has a thicker _____, this is because when it contracts it has to generate the _____ pressure to transport the _____ blood to the whole body. The right ventricle only has to pump blood to the _____ and is under _____ pressure.

Cardiac output – this is the total volume of blood leaving the ventricle per minute

Must know equation: **Cardiac output = stroke volume x heart rate** *(remember to include the units)*

1. Calculate the cardiac output for someone with a stroke volume of 70cm^3 and a heart rate of 75bpm

2. Calculate the heart rate for someone with a stroke volume = 55cm^3, cardiac output =5060 cm^3 min^{-1}

3. Calculate the stroke volume for someone with a heart rate of 65bpm and a cardiac output of 5420cm^3 min^{-1}

Exchange surfaces

What happens to a multicellular organism's surface area to volume ratio as they get bigger? (if in doubt calculate for a cube size 1x1x1 and a cube 2x2x2)

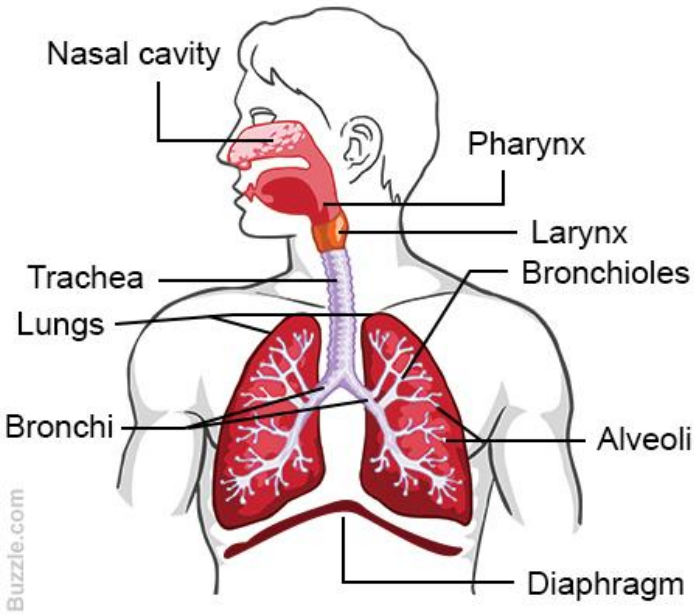
Will diffusion be fast enough for a bigger organism?

What will they need?

The Lungs

The alveoli are the exchange surface in the lungs of all mammals that allow the exchange of ____into the blood and exchange of ____ out of the blood by the process of _____

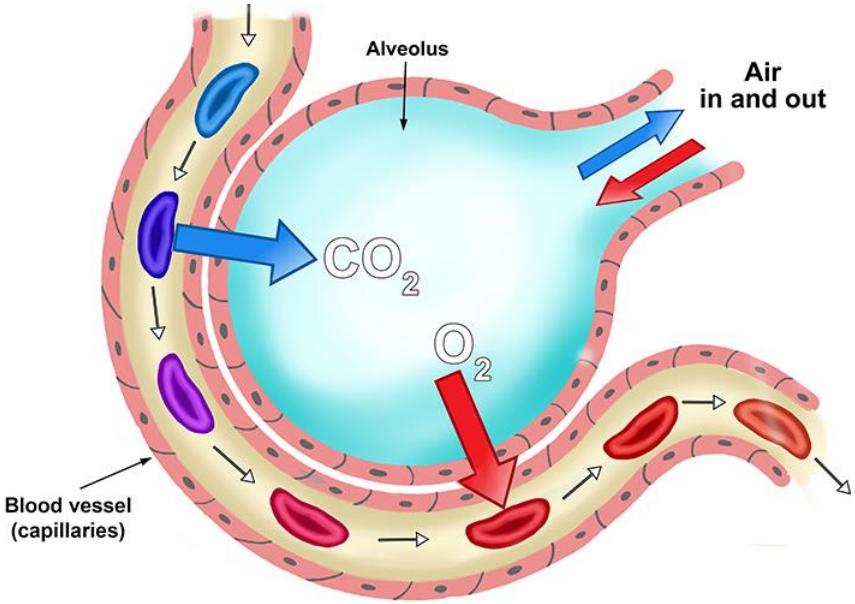
Lung structure



Route of air from inhaling:

Air passes through the nasal cavity, down the_____, this branches into two_____ which then each branch into many _____. At the end of these are the _____ where gaseous exchange occurs.

Exhaled air has a higher concentration of _____ and a lower concentration of _____ compared to inhaled air



On the diagram, label:

Plasma

Blood from the body

Blood going to the body

High CO_2 concentration

Low CO_2 concentration

High O_2 concentration

Low O_2 concentration

How the alveoli are adapted to gaseous exchange – link up the boxes

1 cell thick wall	Large surface area for diffusion
Moist lining	Maintains concentration gradient so that gas diffuses out of blood
Many capillaries surround the alveoli	Dissolves gases before diffusion
Millions of alveoli	Short diffusion distance
High concentration of O_2 in alveoli	Blood moves, maintaining concentration gradient
High concentration of CO_2 in blood	Maintains concentration gradient so that gas diffuses into blood

Fick's Law – describes the rate of diffusion and factors that affect it
Diffusion rate is dependent on: **distance, concentration gradient and surface area**

So for the fastest diffusion you need:

Rate of diffusion α $\frac{\text{surface area x concentration difference}}{\text{thickness of membrane}}$

What will happen to the rate if the surface area doubles?
What will happen to the rate if the thickness of the membrane halves?

Use Fick's Law to describe what happens to the rate of gaseous exchange if someone has damaged alveoli and has thick scar tissue forming in the alveoli? What symptoms will they have?

Questions to try from this topic

Old specification (on T drive for answers)

B2 November 2012 Q5

*(ii) A reduced cardiac output would affect the performance of an athlete.

Explain the effects that a reduced cardiac output would have on the muscle cells of an athlete.

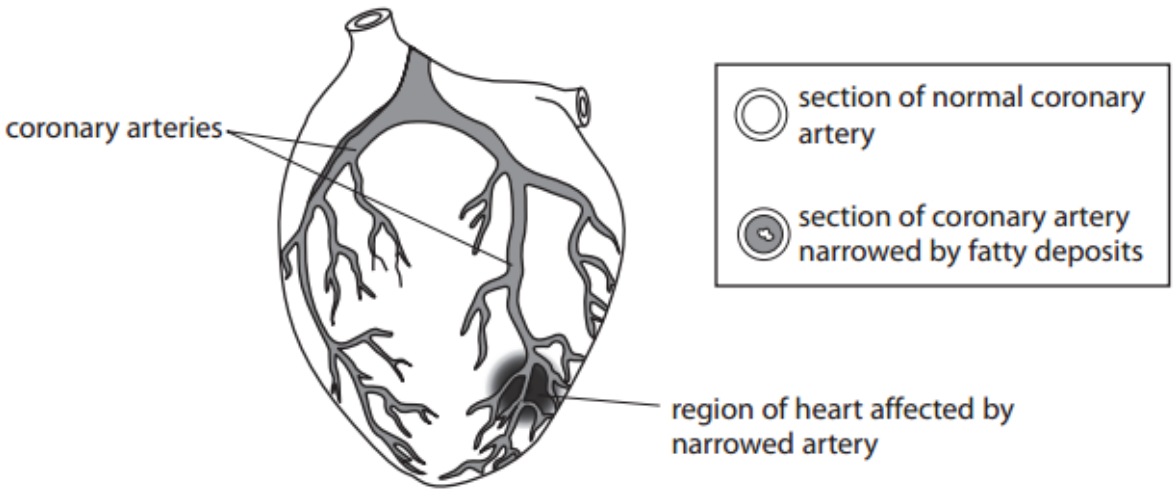
(6)

B2 June 2016 Q5

*(b) The diagram shows the coronary arteries surrounding a human heart.

The coronary arteries deliver blood to the muscle cells in the heart.

The coronary arteries can become narrowed or blocked by fatty deposits.



Suggest how the narrowing of the coronary artery may affect how the heart functions and how this may affect other body cells.

(6)

AQA sam q10

Describe how the human circulatory system works to:

- supply oxygen to the tissues
- remove waste products from tissues.

Include details of the blood vessels and cells involved.

[6 marks]

Edexcel iGCSE Sam paper 1 Q3

A study investigates the effect of training on athletic performance.

In the study, the number of capillaries in the muscle tissue of a person is measured before and after a six-week period of training.

(a) The table shows the results.

Mean number of capillaries per mm^2	
before training	after training
437	460

(i) Explain how training may affect the athletic performance of this person. Use information from the table to support your answer.

(5)

OCR Sam paper 3 q22

(b) Oxygen enters red blood cells by diffusion.

Describe and explain how red blood cells are adapted for the efficient uptake and transport of oxygen.