CHURCH STRETTON SCHOOL

Combined Science - Biology

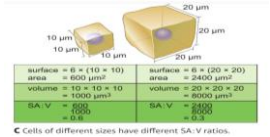
CB8 Knowledge organiser

B8: Exchange and transport

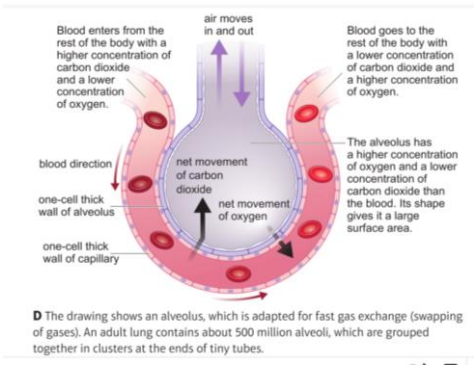
Lesson sequence

1. Efficient exchange and transport
2. The circulatory system
3. The heart
4. Respiration
5. Core practical – respiration rates

1. Efficient exchange and transport	
Substances needed by body	Oxygen, glucose, nutrients.
Waste products	Carbon dioxide, urea.
Transport	Moving substances around the body.
Exchange	Moving substances in and out of our cells.
Diffusion	The way substances move in and out of cells – they diffuse from high to low concentration.
Increasing diffusion	High surface area, thin surfaces
Surface area:volume ratio	Surface area / volume
Importance of SA:volume ratio	A higher ratio means there is more surface area, so substances can diffuse in and out of cells more quickly.
Alveoli	**Role:** Air sacs in lungs where CO_2 and O_2 are exchanged **Adaptations:** millions of them gives a high surface area, good blood supply maintains a high concentration gradient, thin walls increases diffusion



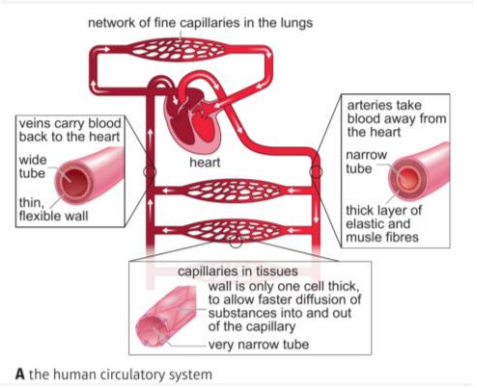
C Cells of different sizes have different SA:V ratios.



D The drawing shows an alveolus, which is adapted for fast gas exchange (swapping of gases). An adult lung contains about 500 million alveoli, which are grouped together in clusters at the ends of tiny tubes.

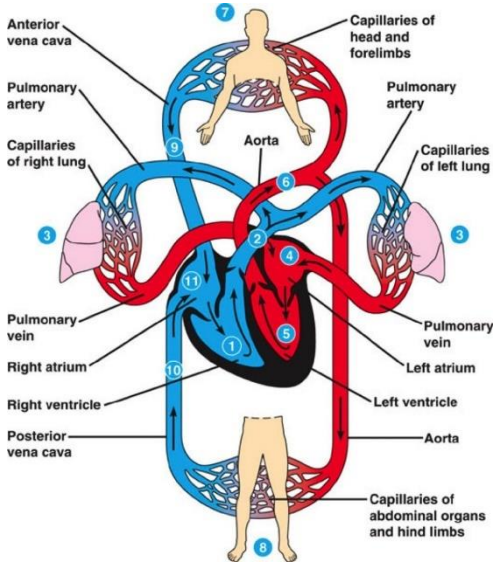
2. Circulatory system	
Circulatory system	Your heart, arteries, capillaries and veins which work together to pump blood around the body.
The role of blood	To carry oxygen and nutrients to our cells and take waste products away.
Arteries	***Role:** Carry blood away from the heart ****Adaptations:** Thick muscle walls to withstand the high pressure, elastic fibres to stretch as pressure increases during a pulse.
Capillaries	***Role:** To exchange nutrients and waste between the blood and cells. ****Adaptations:** Thin walls to increase diffusion, many many of them to give a high surface area.
Veins	***Role:** To carry blood towards the heart ****Adaptations:** Thin walls because pressure is low, wide because blood is moving slowly, valves so blood flows right way.
Components of blood	Plasma, red blood cells, white blood cells, platelets.

Plasma	A straw-coloured liquid that carries the blood cells and dissolved substances such as urea, carbon dioxide and glucose.
Red blood cells (erythrocytes)	Contain haemoglobin to carry oxygen around the body.
White blood cells	Fight pathogens (infections). Many types including: **Phagocytes** – engulf ('eat' pathogens. **Lymphocytes** – produce antibodies to attack pathogens.
Platelets	Small fragments of cells that help the blood to clot when you are cut.



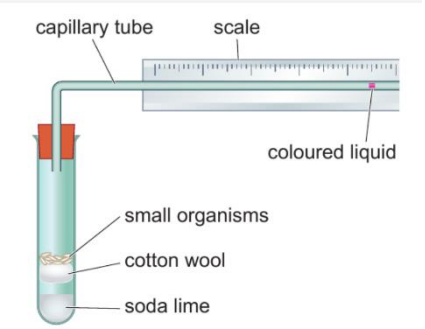
A the human circulatory system

3. The heart	
Heart	A double pump that pumps blood: **Right side**: to lungs **Left side**: around the whole body
Atria (atriums)	The two chambers at the top of the heart. Right: receives blood from body Left: receives blood from lungs
Ventricles	The two chambers at the bottom of the heart Right: pumps blood to lungs Left: pumps blood to body
Valves	Prevent blood from flowing from the ventricles back to the atria
Vena cava	Carries blood from the body into the right atrium.
Pulmonary artery	Carries blood from the right ventricle to the lungs.
Pulmonary vein	Carries blood from the lungs to the left atrium.
Aorta	Carries blood from the left ventricle to the body.
Cardiac output	Cardiac output = stroke volume x heart rate
Increasing cardiac output	Stronger heart beats (higher stroke volume), higher heat rate.



4. Respiration	
Respiration	An exothermic reaction carried out in all living cells to release energy from food molecules such as glucose.
Aerobic respiration	The main type of respiration, which takes place in mitochondria and uses oxygen.
Aerobic equation	glucose + oxygen → carbon dioxide + water
Anaerobic respiration	A form of respiration that releases less energy but extremely quickly. Takes place in the cytoplasm.
Anaerobic equation	Glucose → lactic acid
Role of aerobic respiration	To provide an energy boost during intense exercise when aerobic respiration alone isn't enough.
Lactic acid	A poison that builds up in muscles during anaerobic respiration leading to muscle tiredness and cramp.
Excess post-exercise oxygen consumption	We continue to breath heavily and have a high heart rate after exercise to get lots of oxygen to the muscles to oxidise harmful lactic acid to CO_2 and H_2O.

5. Core practical – rate of respiration (CP5)	
CP5 – Key question	How does temperature affect the rate of respiration in small animals?
CP5 - Set up the respirometer	Place some soda lime (absorbs CO_2) into the test tube put a protective layer of cotton wool over it, add ten maggots, insert in bung with capillary tube and put in water bath to adjust for 5 mins.
CP5 - Run the respiration experiment	Dab the open end of the capillary tube with red food colouring and start the stopwatch.
CP5 - Record results	Every five minutes for fifteen minutes, measure the distance travelled by the food colouring.
CP5 - Vary the temperature	Repeat the experiment in water baths set to different temperatures.
CP5 - Results	The higher the temperature, the faster the animas respire.



B a simple respirometer