Topic: CB9 Ecosystems and Material Cycles (combined)

Duration: 8 lessons

Composite:

Key vocabulary:

Biotic
Abiotic
Ecosystem
Habitat
Niche
Community
Population
independent
Producer
Web
Consumer
Primary
Secondary
Tertiary
Predator
Parasite
Mutualist
Pollutant
Quadrat
Transect
Distribution
Abundance
Indigenous
Native
Non-indigenous
Eutrophication
Endangered
Reforestation
Conservation
Biodiverse
Potable
Biomass
Decomposers
Rotation
Mutualistic

Powerful knowledge

Which organism is a producer in a food chain?

What type of food does a primary consumer eat?

What do the arrows in a food chain indicate?

Describe a belt transect sample

What is a quadrat used for?

How can you ensure quadrat sampling is as accurate as possible?

Name examples of abiotic and biotic factors.

What is meant by biodiversity?

What is a parasite?

What is a mutualist?

What does non-native mean?

Why does eutrophication lead to fish death?

What is desalination?

What is distillation?

Name the process that removes CO_2 in the carbon cycle.

Name 2 other process that release CO_2 in the carbon cycle.

Why do plants need nitrogen?

How do plants obtain nitrogen?

Core knowledge Components

Describe different levels of organisation including organisms, populations, communities to the whole ecosystem.

Describe some relationships between organisms in a habitat. How are animals interdependent and what do they compete for in an ecosystem?

Name the parts of a food chain and the consumers at each trophic level.

Give examples of other types of relationships that are parasitic and mutualistic.

Use data from sampling to estimate the number of individuals in an area.

Link abiotic factors to distribution of organisms.

Give examples of the environmental impact of some pollution events.

Give examples of case studies where reintroductions have increased biodiversity.

Explain the impacts of human activities on diversity including fish farming, introduction of non-native species and eutrophication.

How can the impact of human activity that has reduced biodiversity be reversed?

Describe the processes in the water cycle.

Describe the processes in the carbon cycle and how each part of the process functions.

Explain the impact of burning fossil fuels.

- State the role of microbes in the nitrogen cycle including decomposers, nitrifying bacteria and denitrifying bacteria**.**

Links to previous and future topics

Year 7 Ecology

Year 8 Micro-organisms

Year 9 Environmental Studies
Year 10 – Natural selection

OCR A Mod 4 Biodiversity and Conservation

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
Case studies of reintroductions as part of conservation efforts	Be able to articulate changes in food webs. Be able to articulate the impact of Human activity on the environment	Explain the impact of changes in feeding relationships using concisely and be able to explain sequentially the steps in eutrophication	Develop an understanding of interconnectivity using food webs. Be able to scale up with confidence and use estimates.	Sees a bigger picture, makes links and is aware of global threats. Careers: Ecologist, zoologist, conservationist, agriculturalist, researcher, journalist.
CULTURAL CAPITAL:				
SEND Clear outline of key vocab. Misconceptions outlined, start of lesson retrieval practice, delivery chunked into associated topics and within the lesson. Dual codes where possible and demonstrations with explicit instructions, targeted discussion and questioning with empathetic seating and grouping				

YEAR 11 COMBINED SCIENCE Topic: Exchange & Transport		Duration: 9 lessons	Composite: Unit test
Key vocabulary:	**Core knowledge Components**	**Powerful knowledge components crucial to commit to long term memory**	**Links to previous and future topics**
Excretion Absorption Respiration Aerobic Anaerobic Ventilation Diffusion Osmosis Facilitated diffusion Active transport Lungs Trachea Bronchi Bronchioles Alveoli Ciliated epithelium Cilia Goblet cells Mucus Gas exchange Concentration gradient Surface area Diffusion distance Heart Chamber Atrium Ventricle Artery Vein Capillary Valve Double circulation Single circulation Plasma	**1.** What substances are excreted from cells? **2.** What substances are needed to be absorbed by cells. **3.** What are the three main ways substances enter cells? **4.** What adaptations are in the lungs to increase surface area for absorption and excretion of gases? **5.** What adaptations are there in alveoli? **6.** What are the three main blood vessels? **7.** Which blood vessels carry mainly oxygenated blood at high pressure? **8.** Which blood vessels carry mainly de-oxygenated blood at lower pressure? **9.** What are the adaptations in the capillary to allow exchange? **10.** What is meant by double circulation? **11.** Name the four chambers of the heart? **12.** Why is the left side more muscular? **13.** What is the purpose of the heart valves? **14.** What is a pulse? **15.** What is the equation to determine cardiac output? **16.** What is meant by stroke volume?	Powerful Knowledge Which gases are exchanged in the lungs? Which process is happening during gas exchange? Where in the lungs are gases exchanged? Name the four components of blood Name the chambers of the heart What is the purpose of heart valves? State the equation for aerobic respiration State the equation for anaerobic respiration Explain why cardiac output increases with exercise. Which part of a respirometer indicates the rate of respiration?	KS3: Cells, Moving & Breathing KS4: Key concepts

Red blood cell White blood cell Platelet Cardiac output Stroke volume Heart rate Pulse rate Muscle Respirometer Blood pressure			

Impressive reading	Impressive speaking	Impressive writing	Resilience	Graph/Numeracy skills:	Employability via:
Read with purpose: spot the error activity	Discuss with members of a group how medical condition affect Fick's law	To tie in with culture capital activity about lung damage/emphysema. Students write an explanation of how the damaged alveoli experienced in emphysema compromise efficient gas exchange.	• Use of transferable mathematical skills. • Scientific investigation skills in using fiddly equipment.	• Calculations involved in surface area: volume ratios • Use of Fick's law equation to work out rate of diffusion • Use of/rearranging of the cardiac output equation • Calculating respiratory rate from data obtained using a respirometer, data analysis & graph	Doctor, nurse, physiotherapist, sports therapist, personal trainer, athlete, paramedic.

Culture capital:

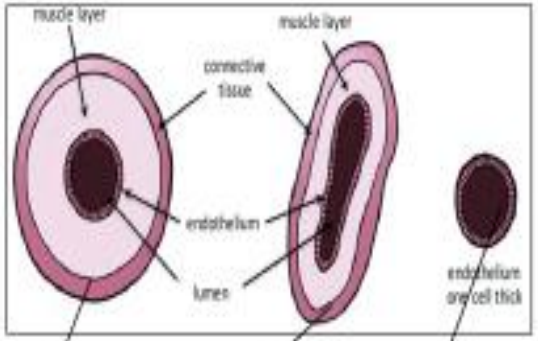
- Adolf Eugen Fick: responsible for Fick's law used to calculate rate of diffusion; and also equation for cardiac output
- EMPHYSEMA: caused by smoking, pollution etc. Damages alveoli and compromises gas exchange.
- Uses of cardiac output in diagnosis & treatments

SEND

Communication & Interaction	Cognition & Learning	SEMH	Physical/Sensory
• Unambiguous terms and clear language used is presentations/handouts • Unambiguous terms and clear language used by teacher • ADHD pupils are given instructions directly by use of their names Use of post-it plans to help pupils work through a task	• Chunking of activities into manageable portions, so as not to lead to cognitive overload • Use of low stakes/high gains activities for knowledge recall • Topics are mapped out visually for pupils to see Links to previous learning established	• Consideration to seating positions • Awareness of specific pupil triggers Communication channels kept open	• Consideration to seating positions • Clear access for physically compromised pupils Opportunities for different sensory learning activities threaded into topics

YEAR 11 COMBINED SCIENCE EXCHANGE & TRANSPORT KNOWLEDGE ORGANISER

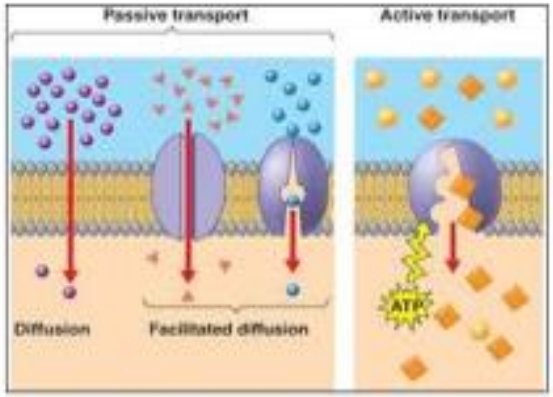
Cell secrete and excrete various substances E.g. waste products, CO2, urea, hormones, other chemical.
They also need to absorb certain things E.g. food molecules, hormones, oxygen, water,
They do these things using several methods of cellular transport.

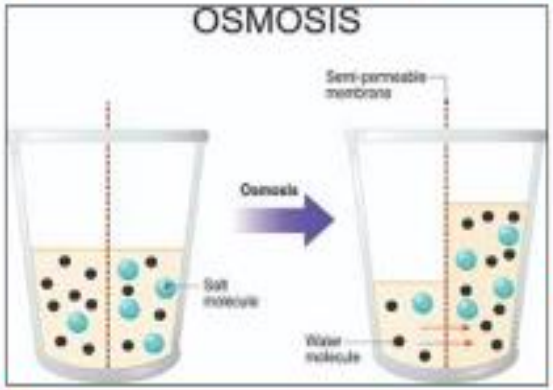


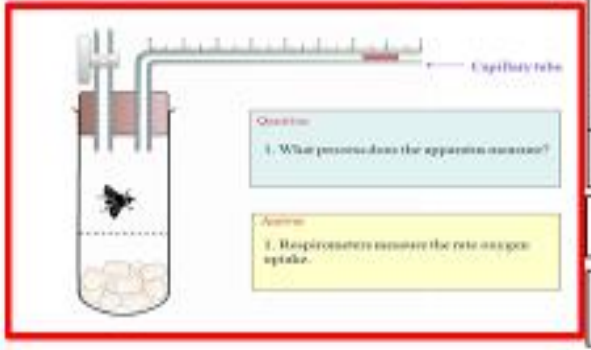
Artery	Vein	Capillary
Carry blood away from the heart	*Carry blood to the heart*	*Connects arteries and veins*
Thick muscular walls, small lumen, carry blood under high pressure, carry oxygenated blood (except for the pulmonary artery).	Thin walls, large lumen, carry blood under low pressure, have valves to stop flow in the wrong direction, carry deoxygenated blood (except for the pulmonary vein).	One cell thick to allow diffusion, Carry blood under very low pressure.

Exchange surfaces in the body

Efficient exchange surfaces have a large surface area, a short diffusion distance and a steep concentration gradient.







Small intestines	*Villi – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.*
Lungs	*Alveoli– increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.*
Gills in fish	*Gill filaments and lamella – increase surface area, Good blood supply – to maintain concentration gradient, Thin membranes – short diffusion distance.*
Roots	*Root hair cells - increase surface area.*
Leaves	*Large surface area, thin leaves for short diffusion path, stomata on the lower surface to let O_2 and CO_2 in and out.*

Aerobic respiration

Respiration with oxygen. Occurs inside the mitochondria continuously

Glucose is oxidised by oxygen to transfer the energy the organism needs to perform it's functions.

$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$

glucose + oxygen → carbon dioxide + water

Anaerobic respiration

Respiration when oxygen is in short supply. Occurs during intensive exercise

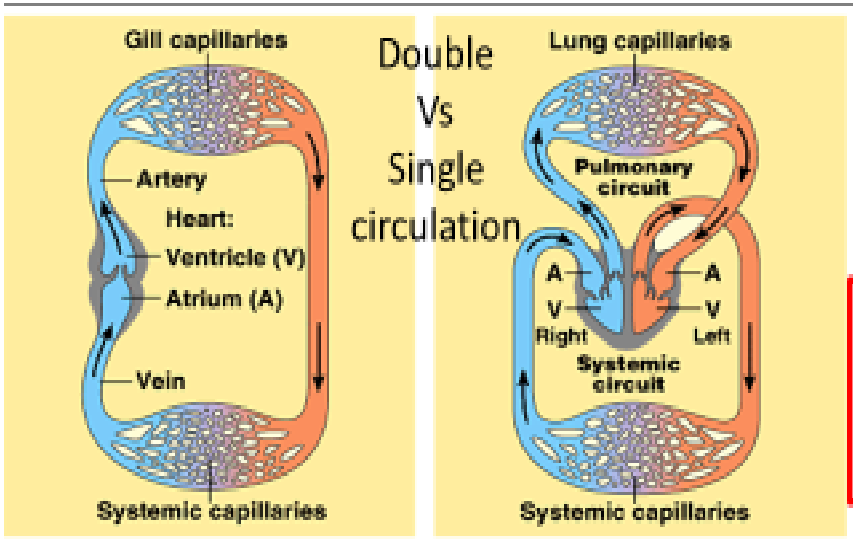
During hard exercise, muscle cells are respiring so fast that blood cannot transport enough oxygen to meet their needs.

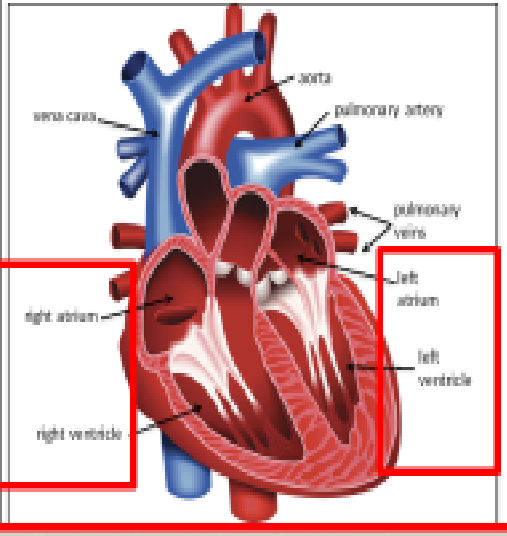
Glucose is partially oxidised to produce lactic acid which builds up in muscle tissue causing them to become painful and fatigued.

glucose → lactic acid

Anaerobic respiration releases a much smaller amount of energy than aerobic respiration.

The incomplete oxidation of glucose causes a build up of lactic acid and creates an oxygen debt





Different structure in the heart have different functions	
Right ventricle	Pumps blood to the lungs where gas exchange takes place.
Left ventricle	Pumps blood around the rest of the body. Thicker cardiac muscle in the wall.
Pacemaker (in the right atrium)	Controls the natural resting heart rate. Artificial electrical pacemakers can be fitted to correct irregularities.
Coronary arteries	Carry oxygenated blood to the cardiac muscle.
Heart valves	Prevent blood in the heart from flowing in the wrong direction.

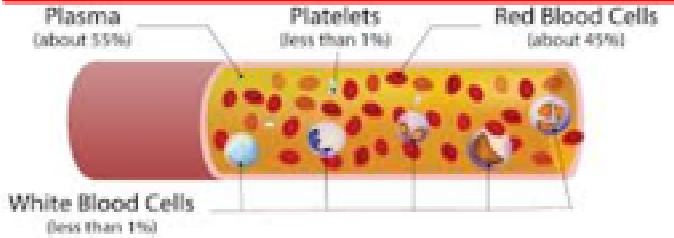
What Is a Pulse?

- When the heart beats, it sends a wave, or pulse, of blood through the arteries

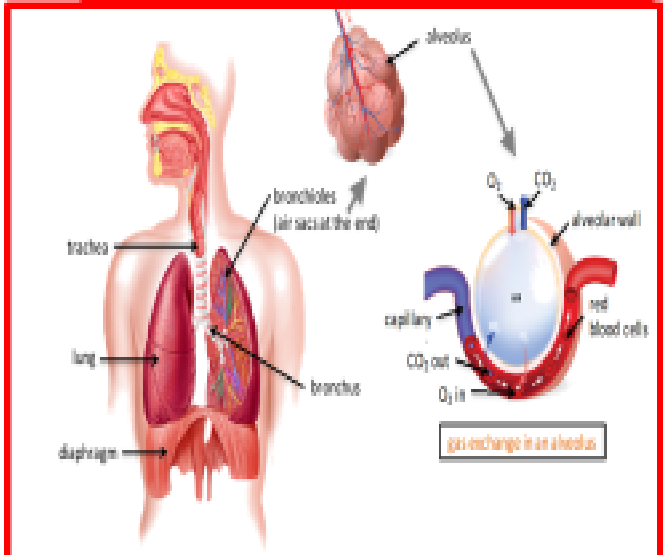
Cardiac Output, Stroke Volume, and Heart Rate

- Cardiac Output – amount of blood leaving the heart per minute (L/min)
- Stroke Volume – amount of blood heart pumps with each beat
- Heart rate – number of beats per minute
- CO = SV x HR

COMPOSITION OF BLOOD



Trachea	*Carries air to/from the lungs*	Rings of cartilage protect the airway.
Bronchioles	*Carries air to/from the air sacs (alveoli)*	Splits into multiple pathways to reach all the air sacs.
Alveoli	*Site of gas exchange in the lungs*	Maximises surface area for efficient gas exchange.
Capillaries	*Allows gas exchange between into/out of blood*	Oxygen diffuses into the blood and carbon dioxide diffuses out.



Plasma (55%)	*Pale yellow fluid*	Transports CO_2, hormones and waste.
Red blood cells (erythrocytes)(45%)	*Carries oxygen*	Large surface area, no nucleus, full of haemoglobin.
White blood cells (phagocytes and lymphocytes)(<1%)	*Part of the immune system*	Some produce antibodies, others surround and engulf pathogens.
Platelets (<1%)	*Fragments of cells*	Clump together to form blood clots.