PiXL Gateway: Progression – Biology

Year 12-13 Biology

Contents:

I. Biology Vocabulary

SCIENCE - BIOLOGY:

Currently, within the Biology section of the app, we have the following units:

- Biological molecules
- The nervous system
- Enzymes
- Cardiovascular system
- DNA, genetics and protein synthesis

Biological Molecules Keywords and Definitions

Word	Definition
monosaccharide	A monosaccharide is a sugar that is not decomposable into simpler sugars by hydrolysis.
Benedict's reagent	Benedict's reagent in used in a chemical to detect the presence of reducing sugars.
Biuret test	The Biuret test is chemical test that detects the presence of peptide bonds in a protein molecule.
condensation reaction	A condensation reaction is a chemical reaction where two molecules combine to form a larger molecule, producing a small molecule such as water as a by-product.
disaccharide	A disaccharide is the sugar formed when two monosaccharides (simple sugars) are joined by a glycosidic bond.
DNA polymerase	DNA polymerase is an enzyme that joins adjacent nucleotides by a condensation reaction.
elimination	An organic reaction in biology where two atoms, or groups of atoms, are removed from a molecule. This is called an elimination reaction.
emulsion	An emulsion is the fine distribution of minute droplets of one liquid in another in which it is not soluble or miscible.
ester bond	A ester bond formed by a condensation reaction between an alcohol group (e.g. glycerol) and a carboxylic group (e.g. fatty acid).
fibrous	Fibrous proteins are wire or rod shaped proteins and they are only found in animals.
globular proteins	Globular proteins are spherical or globe-like proteins.
glycosidic bond	A glycosidic bond is formed between monosaccharides.
helicase	Helicase is an enzyme that binds to a DNA molecule, causing it to unwind and break its hydrogen bonds.
hexose	Hexose sugars are simple sugars where each molecule contains six carbon atoms.
hydrolysis	Hydrolysis is the chemical breaking of bonds in polymers due to a reaction with a water molecule.
hydrophilic	Polar molecules that dissolve in water are hydrophilic. It literally means "water liking".
hydrophobic	Non-polar molecules that do not dissolve in water are hydrophobic. It literally means "water fearing".
lipid	A lipid is a fatty organic compound that is insoluble in polar solvents (e.g. water) but soluble in non-polar solvents (e.g. ether).
monomer	A monomer is a molecule that can be bonded to other identical molecules to form a polymer.

nucleotide	A nucleotide is one of the structural components, or building blocks, of DNA and RNA. It consists of a base, a sugar molecule and one phosphate group.
pentose	Pentose sugars are simple sugars where each molecule contains five carbon atoms.
peptide bond	A peptide bond is formed between two molecules when the carboxyl group of one molecule reacts with the amino group of the other molecule. It is an example of a condensation reaction.
phosphodiester bond	A phosphodiester bond is formed between the 3' carbon atom of one sugar molecule and the 5' carbon atom of another, deoxyribose in DNA and ribose in RNA.
phospholipid	A phospholipid is a type of lipid molecule that is made up of two fatty acids, a phosphate group and a glycerol molecule.
polymer	A polymer has a molecular structure made from a large number of similar units bonded together.
polynucleotide	A polynucleotide is a polymer chain of nucleotides.
polypeptide	A polypeptide is a polymer chain of amino acids.
polysaccharide	A polysaccharide is a carbohydrate (e.g. starch, cellulose or glycogen) where the molecules consist of a number of sugar molecules bonded together.
primary	Primary means the first stage or group of something - e.g. molecule, process or structure.
quaternary	Quaternary means the fourth stage or group of something - e.g. molecule, process or structure.
saturated	A saturated organic compound has no double bonds between carbon atoms - e.g. animal fats
secondary	Secondary means the second stage or group of something - e.g. molecule, process or structure.
semi-conservative replication	Semi-conservative replication is a type of genetic replication where a double-stranded molecule of nucleic acid separates into two single strands each then acts as a template for the formation of a complementary strand that, together with the template, forms a complete molecule.
synthesis	Synthesis means the production of chemical compounds by reactions of simpler materials.
tertiary	Tertiary means the third stage or group of something - e.g. molecule, process or structure.
triglyceride	A triglyceride is a molecule formed from glycerol and three fatty acid groups.
unsaturated	An unsaturated organic compound has one or more double bonds between carbon atoms - e.g. plant oils

The nervous system Keywords and Definitions

Word	Definition
action potential	An action potential occurs the when the potential difference across a membrane is briefly reversed.
autonomic nervous system	The autonomic nervous system is responsible for control of the bodily functions not consciously directed, such as breathing, the heartbeat and digestive processes.
axon	An axon is the long nerve fibre of a motor neurone that carries the nerve impulse.

central nervous system	The central nervous system is made up of brain and the spinal cord.
cerebellum	The cerebellum is an area of the brain at the back of the skull in vertebrates, that coordinates and regulates muscular activity.
cerebrum	The cerebrum is an area of the brain responsible for conscious thought, personality and control of movement.
coordinate	In biology, the word coordinate means different biological processes or systems working together.
dendron	A dendron is the long nerve fibre of a sensory neurone that carries the nerve impulse.
detect	In biology, the word detect means to find a change in a system or the presence of something new.
effector	An effector is a muscle or gland that has an effect when stimulated. It brings about the response.
gland	A gland is an organ in the body that releases chemical substances in response to a change.
hormone	A hormone is a chemical messenger that is released into the blood from a gland and causes target cells to change how they work.
hypothalamus	The hypothalamus is an area of the brain that coordinates the autonomic (unconscious) nervous system.
impulse	An impulse is an electrical signal that is transmitted through the nervous system.
medulla oblongata	The medulla oblongata is the most primitive area of the brain that controls reflexes, breathing, heart rate and other involuntary actions.
motor neurone	A motor neurone is a type of nerve cell that carries electrical impulses from the central nervous system to effectors.
myelin sheath	Myelin sheath is a fatty insulating layer surrounding some neurones. It is formed from Schwann cells.
neurone	A neurone is nerve cell that is specialised to rapidly transmit electrical impulses.
neurotransmitter	A neurotransmitter is a chemical transmitting a signal across a synapse.
nodes of Ranvier	The nodes of Ranvier are the gap between the Schwann cells of myelinated neurones that allow saltatory conduction to occur.
parasympathetic nervous system	The parasympathetic nervous system is part of the autonomic nervous system, its role is to inhibit bodily functions or to slow down an organ system.
pathway	A pathway is a route, formed by a chain of nerve cells, along which impulses travel.
receptor	A receptor is found in a sense organ, they detect a change in the environment.
reflex action	A reflex action is an automatic and rapid response to a stimulus.
relay neurone	A relay neurone is a type nerve cell that transmits electrical impulses from sensory neurones to motor neurones.
response	A response is an action that occurs following a stimulus.
saltatory conduction	Saltatory conduction is the process where action potentials are transmitted from one node of Ranvier to the next in a myelinated neurone.
sensory neurone	A sensory neurone is a nerve cell that transmits electrical impulses from receptors in the sense organs to the central nervous system.

specialised	When a cell is adapted for a particular function we call it specialised.
stimulus	A stimulus is any change in the environment that is detected by a receptor in a sense organ.
sympathetic nervous system	The sympathetic nervous system is part of the autonomic nervous system, its role is to stimulate the body to prepare the body for a rapid response or to activate an organ system.
synapse	The synapse is a tiny gap between two nerves across which the impulse must pass.
synaptic vesicles	Synaptic vesicles are membrane bound sacs in the pre-synaptic knob that contain neurotransmitter molecules.
transmit	Transmit means when a substance or energy is passed through a medium (substance).
voluntary nervous system	The voluntary nervous system is part of the peripheral nervous system that involves motor neurones and is associated with the voluntary control of body movements via skeletal muscles.

Enzymes Keywords and Definitions

Word	Definition
activation energy	Activation energy is the amount of energy required for a reaction to take place.
active site	The active site is the part of the enzyme where the substrate attaches.
catalyst	A catalyst is a chemical that speeds up reaction without being used up.
competitive inhibitor	A competitive inhibitor has a similar structure to a substrate. Prevents the substrate from binding with the active site.
denature	Denature is where the tertiary structure of an enzyme has changed and the active site is no longer complementary to the substrate.
enzyme-substrate complex	An enzyme-substrate complex is formed when a substrate is combined with the active site of an enzyme.
extracellular	Extracellular means something that is situated or taking place outside a cell or cells.
gradient	Gradient means the increase or decrease in the magnitude (size) of a property.
induced-fit model	The induced-fit model is where the exposure of an enzyme to a substrate causes the active site of the enzyme to change shape in order to allow the enzyme and substrate to bind.
inhibitor	An inhibitor is a substance that prevents or reduces enzyme activity.
initial	Initial means existing or occurring at the beginning.
intracellular	Intracellular means something that is situated or taking place within a cell or cells.
lock and key model	The lock and key model is where the shape of the active site is completely complementary to the shape of its substrate molecules. This makes enzymes highly specific.

non-competitive inhibitor	A non-competitive inhibitor is a substance that binds to an enzyme and changes the shape of active site.
optimum	Optimum means the conditions that are most suitable for a reaction to occur or an organism to live in.
plateau	A plateau is a state of little or no change following a period of activity.
rate	Rate means the frequency at which something happens.
specificity	Enzymes specificity is where enzymes normally only catalyse one reaction.
substrate	A substrate is the molecule that binds to the active site of an enzyme.

Cardiovascular system Keywords and Definitions

Word	Definition
arterioles	Arteries divide into smaller vessels called arterioles.
artery	An artery refers to any of the tubes forming part of the blood circulation system of the body, carrying mainly oxygen-rich blood away from the heart.
atrioventricular node (AVN)	The atrioventricular node (AVN) is the cluster of cells that pass electrical impulses to the bundle of His.
atrioventricular valve	An atrioventricular valve is a valve between atria and the ventricles of the heart.
atrium	An atrium is an upper chamber of the heart.
autonomic nervous system	The autonomic nervous system is responsible for control of the bodily functions not consciously directed, such as breathing, the heartbeat and digestive processes.
bundle of His	The bundle of His is a group of muscle fibres that carry electrical impulses that regulate the heartbeat.
capillary	A capillary is the smallest type of blood vessels where exchange of substances with tissues occurs.
cardiac	The word cardiac means anything relating to the heart.
cardiac cycle	The cardiac cycle is the events that occur in one complete heartbeat.
chemoreceptors	Chemoreceptors monitor the concentration of chemicals in the blood - e.g. oxygen, carbon dioxide and pH.
coronary	The word coronary means anything relating to the heart.
diastole	Diastole is the phase of the heartbeat when the heart muscle relaxes and allows the chambers to fill with blood.
dissociation	Dissociation is a chemical reaction in which a compound breaks apart into two or more parts.
electrocardiogram	An electrocardiogram is a display (trace) showing a person's heartbeat.
haemoglobin	Haemoglobin is a protein found in red blood cells that combines with oxygen.
heart rate	The heart rate is the number of times the heart beats per minute.

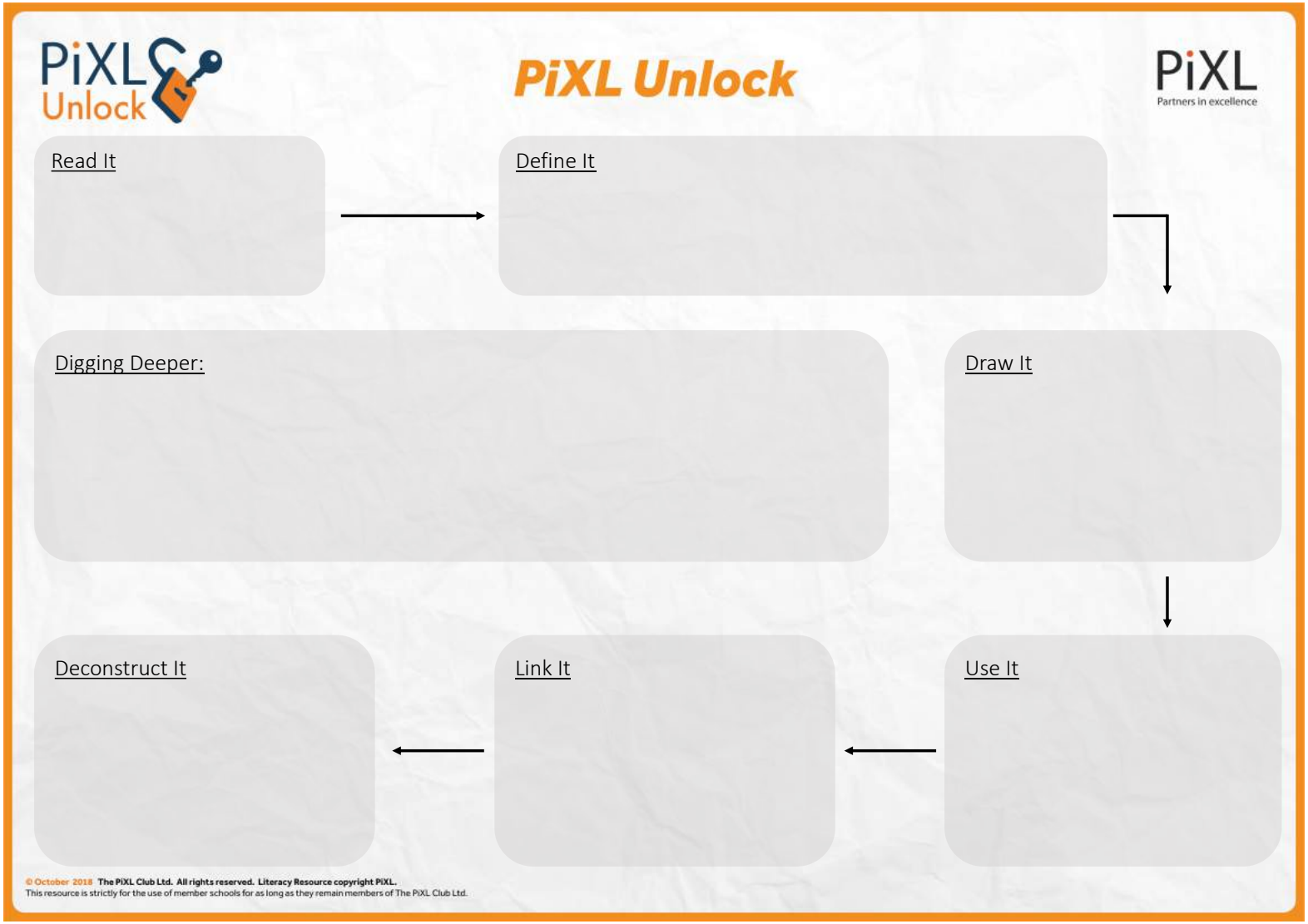
lumen	The lumen is the central cavity of a tubular or other hollow structure in an organism or cell.
medulla oblongata	The medulla oblongata is the most primitive area of the brain that controls reflexes, breathing, heart rate and other involuntary actions.
pressure	Pressure is the continuous physical force exerted on or against an object by something in contact with it.
purkyne (purkinje) tissue	Purkyne (purkinje) tissue is a network of fibres that receive conductive signals originating at the atrioventricular node (AVN) and simultaneously activate the left and right ventricles.
quaternary	Quaternary means the fourth stage or group of something - e.g. molecule, process or structure.
semi-lunar valve	A semi-lunar valve is one of two valves, one in the aorta and one in the pulmonary artery, consisting of a set of three crescent-shaped flaps of tissue and serving to prevent blood from flowing back into the heart after contraction.
sino-atrial node (SAN)	The sino-atrial node (SAN) is the heart's natural pacemaker, it consists of a cluster of cells that are situated in the upper part of the wall of the right atrium.
stroke volume	Stroke volume is volume of blood pumped from the left ventricle in one heart beat.
systole	Systole is the phase of the heartbeat when the heart muscle contracts and pumps blood from the chambers into the arteries.
vein	A vein is any of the tubes forming part of the blood circulation system of the body, carrying mainly oxygen-depleted blood towards the heart.
ventricle	A ventricle is the lower chamber of the heart.
volume	Volume is the amount of space that a substance or object occupies.

DNA, genetics and protein synthesis Keywords and Definitions

Word	Definition
allele	An allele is an alternative form of a gene that arises by mutation and is found at the same place on a chromosome.
autosomal	Autosomal chromosomes are not sex chromosomes.
chromosome	A chromosome is a thread-like structure of nucleic acids and protein found in the nucleus of most living cells, carrying genetic information in the form of genes.
codominant	Codominant alleles are both expressed in the phenotype.
degenerate code	Degenerate code is where more than one triplet code codes for a specific amino acid.
dihybrid	Dihybrid genetic crosses show the effect on two genes.
dominant	A dominant allele is expressed in the phenotype, even if there is only one copy.
epistasis	Epistasis is the phenomenon where the effect of one gene (locus) is dependent on the presence of one or more 'modifier genes'.
exon	An exon is an mRNA nucleotide sequence remaining when the introns have been spliced out.

gamete	A gamete is the male or female reproductive cell that contains half the genetic material of the organism.
gene	A gene is a sequence of bases on DNA which codes for a protein.
genome	The genome is the complete set of genes in a cell.
genotype	The genotype is the genetic constitution of an organism.
heterozygous	In diploid organisms, heterozygous refers to an individual having two different alleles for a specific trait.
homozygous	In diploid organisms, homozygous refers to an individual having two of the same alleles for a specific trait.
intron	An intron is a segment of a DNA or RNA molecule which does not code for proteins and interrupts the sequence of genes.
locus	The locus is the fixed position of a gene on a chromosome.
monohybrid	Monohybrid genetic crosses show the effect on one gene.
non-coding	A non-coding section of DNA is one which does not code for a protein.
nucleotide	A nucleotide is one of the structural components, or building blocks, of DNA and RNA. It consists of a base, a sugar molecule and one phosphoric acid molecule.
phenotype	The phonotype is an expression of genetic constitution and its interaction with the environment.
proteome	The proteome is all of the proteins that are coded for by the genome of a cell, tissue or organism.
punnett square	A punnet square is the method of showing a genetic cross.
recessive	A recessive allele is one which is only expressed in the phenotype if there are two copies.
sex-linkage	Sex-linkage is where an allele is located on the sex chromosome.
transcription	Transcription is where the DNA code is converted into mRNA molecule in the nucleus.
translation	Translation is where mRNA is translated into a sequence of amino acids in the cytoplasm of a cell.

II. The PiXL Unlock Template



III. Summer Reading list

- The Chemistry of Life (Steven Rose)
- Anything by the geneticist Steve Jones (note particularly Language of the Genes,Almost Like a Whale and Y:The Ascent of Man)
- Genome (Matt Ridley)
- The Wisdom of the Genes (Wills)
- Life on the Edge: Quantum
- Biology (Al-Khalili and MacFadden)
- The Selfish Gene and The Extended Phenotype (Dawkins)
- Junk DNA (Carey)
- Life Ascending (Nick Lane)
- The Revenge of Gaia (Lovelock)
- 50 Genetic Ideas You Really Need To Know (Henderson)
- Zoobiquity (Horowitz and Bowers)
- Creation: The Origin of Life (Rutherford)
- The Sixth Extermination (Kolbert)
- Great Myths of the Brain (Jarrett)
- The Gene – an Intimate History (Mukherjee)
- How We Live and Why We Die (Wolpert)
- Honeybee Democracy (Seeley)

IV. Links to TED Talks/Articles/Documentaries/Books/Journals

1. **TED talk – How a new species of ancestors is changing our theory of human evolution.**

   How the discovery of *Homo naledi* is forcing us to rethink where we come from – and what it means to be human.
   https://www.ted.com/talks/juliet_brophy_how_a_new_species_of_ancestors_is_changing_our_theory_of_human_evolution?language=en

2. **TED talk – How you can help save the bees, one hive at a time.**

   Learn how ecologists are using citizen scientists to find out where bees are healthy and how this is changing what we know about habitats bees need to thrive.
   https://www.ted.com/talks/noah_wilson_rich_how_you_can_help_save_the_bees_one_hive_at_a_time?language=en

3. **BBC Sounds – Science betrayed**

   What happens when science goes bad? From the anthropological hoax of Piltdown man in 1912, to recent cases such as Dr Hwang Woo-suk accused of faking his 'breakthrough' into stem cell research.
   https://www.bbc.co.uk/sounds/play/b00zf4ns

4. **BBC Sounds – Callum Roberts on the urgent need for marine conservation.**

   As early as the 12th century laws were being put in place to help preserve fishing stocks. Two hundred years ago off the coast of Britain a diverse array of sea fans and sponges covered the sea floor. There were millions of oysters and scallops the size of dinner plates. How can we protect our oceans and still eat fish?
   https://www.bbc.co.uk/sounds/play/b00zf4ns

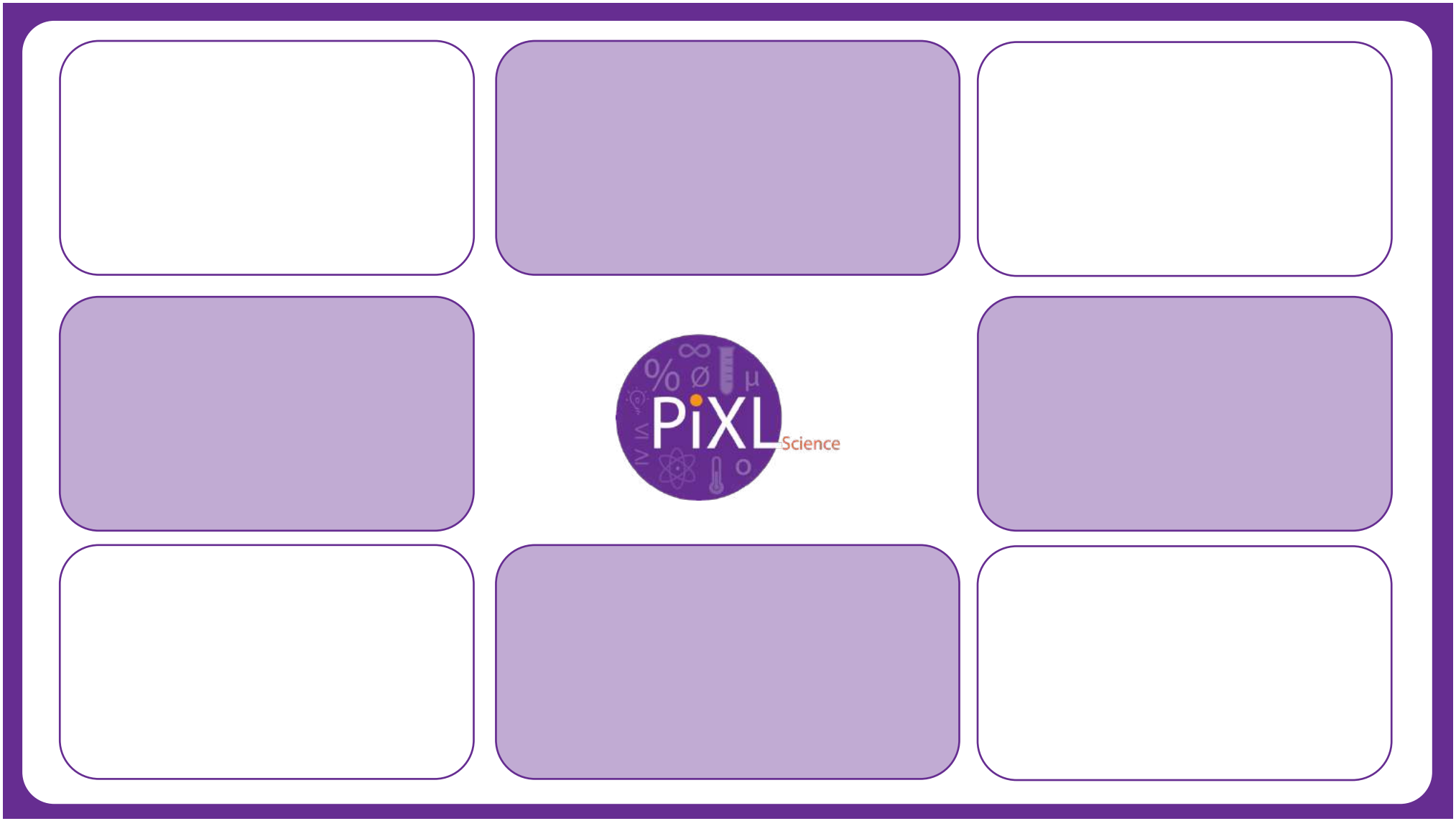
5. **Article in Nature – Pig brains kept alive outside body for hours after death.**

   Revival of disembodied organs raises a host of ethical and legal questions about the nature of death and consciousness.
   https://www.nature.com/articles/d41586-019-01216-4

6. **Careers – Royal Society of Biology - Next steps with biology**

   Wondering where to go next? This site contains a number of different resources showcasing careers available to those studying biology to A-Level.
   https://www.rsb.org.uk/images/Becoming_a_Biologist_Degrees_and_Careers_in_Biology.pdf

V. Knowledge Organiser Template



VI. Thinking Hard Revisit Template

Name of Topic: _____

Name: _____

Class: _____

Turn the material you have read into up to six pictures – one per paragraph or one per key piece of information. The pictures must represent the information so that they can act as a reminder of what the text said. Underneath each picture, explain your thinking.

1.	**2.**	**3.**

4.	**5.**	**6.**

Now restore your pictures back into their original form.

VII. A Model of the Thinking Hard Revisit document

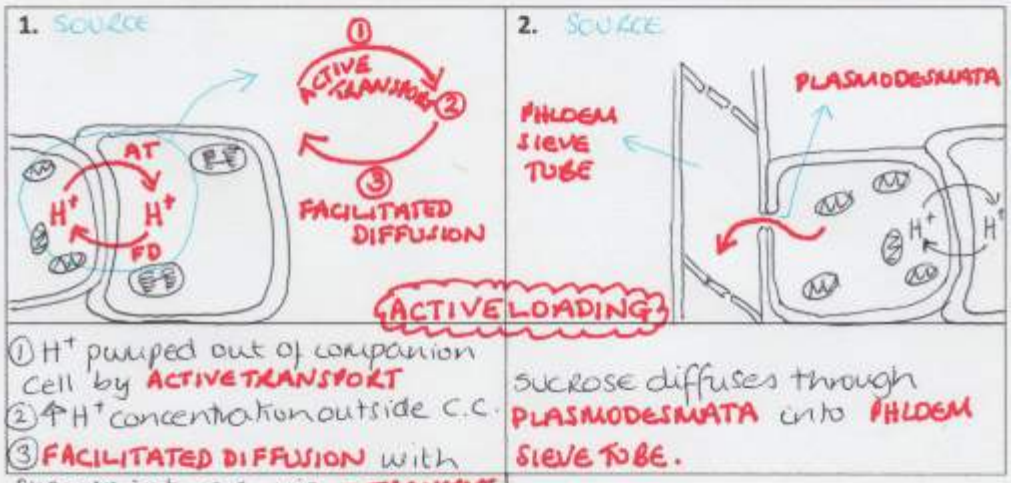
PiXL Revisit: Transforming

Name of Topic: TRANSLOCATION FROM SOURCE TO SINK

Name: A. Student

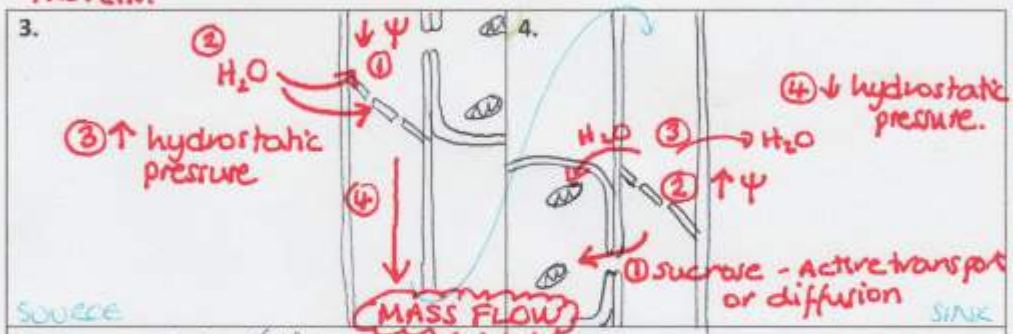
Class: A-level Biology

Turn the material you have read into up to 6 pictures – one per paragraph or one per key piece of information. The pictures must represent the information so that they can act as a reminder of what the text said. Underneath each picture, explain your thinking.



① H^+ pumped out of companion cell by ACTIVE TRANSPORT
② ↑ H^+ concentration outside C.C.
③ FACILITATED DIFFUSION with sucrose into C.C. via COTRANSPORT PROTEIN.

Sucrose diffuses through PLASMODESMATA into PHLOEM SIEVE TUBE.



① water potential (Ψ) ↓ in phloem sieve tube where active loading occurs.
② water diffuses in by osmosis
③ There is an increase in hydrostatic pressure
④ sap forced around phloem to lower hydrostatic pressure.

① Sucrose moves out of phloem sieve tube by diffusion/active transport
② water potential ↑ in phloem
③ water diffuses out by osmosis
④ keeps hydrostatic pressure low in the sink.

Now restore your pictures back into its original form.

VIII. Cornell Notes Template

Name	Date
Topic	Subject

Main Ideas	Notes

Summary

IX. A Model of the Cornell Notes document

Cornell Notes

Notes from youtube clip Crashcourse Biology#2

Name A. Student	Date Today
Topic Water	Subject Biology

Main Ideas

- Polar
- Hydrogen bonds
- High cohesion resulting in high surface tension
- Adhesion
- capillary action
- hydrophillic polar molecules
- hydrophobic non-polar molecules
- universal solvent
- Ice less dense than water
- High S.H.C
- Sweating

Notes

H_2O - covalent bonds

polarity

weak hydrogen bonds between molecules. $\delta^- \cdots \delta^+$

High cohesion resulting in high surface tension → attraction between 2 like things.

→ enables insects etc to walk on water

Adhesion - water likes to stick to other substances e.g. glass.

→ attraction between two different substances

capillary action - water molecules adhere to the inside surface of the tube other water molecules are drawn in by cohesion. Surface tension causes water to climb up the tube until gravity prevents further height gain.

polarity → pola.

polarity ⇒ v. good solvent. hydrophillic Substances polarity is stronger than cohesive forces of water. hydrophobic → cannot overcome the cohesive forces of water. → non-polar. *

Sweating → heat excites water molecules, h-bonds break.

Summary water is polar and forms hydrogen bonds. Water universal solvent; has adhesion + cohesion which enables capillary action. Ice is less dense than water. Surface tension allows insects to ~~water~~ walk on surface. v. high SHC → oceans help maintain climate

* Henry Cavendish - recognised $H_2(g)$ + composition of water. composition of atmosphere + density of Earth.

Ice density - less than liquid - hydrogen bonds - molecules spaced out evenly.

Heat capacity - v. high. v. good at holding heat → hard to heat/cool oceans easily 2 climate