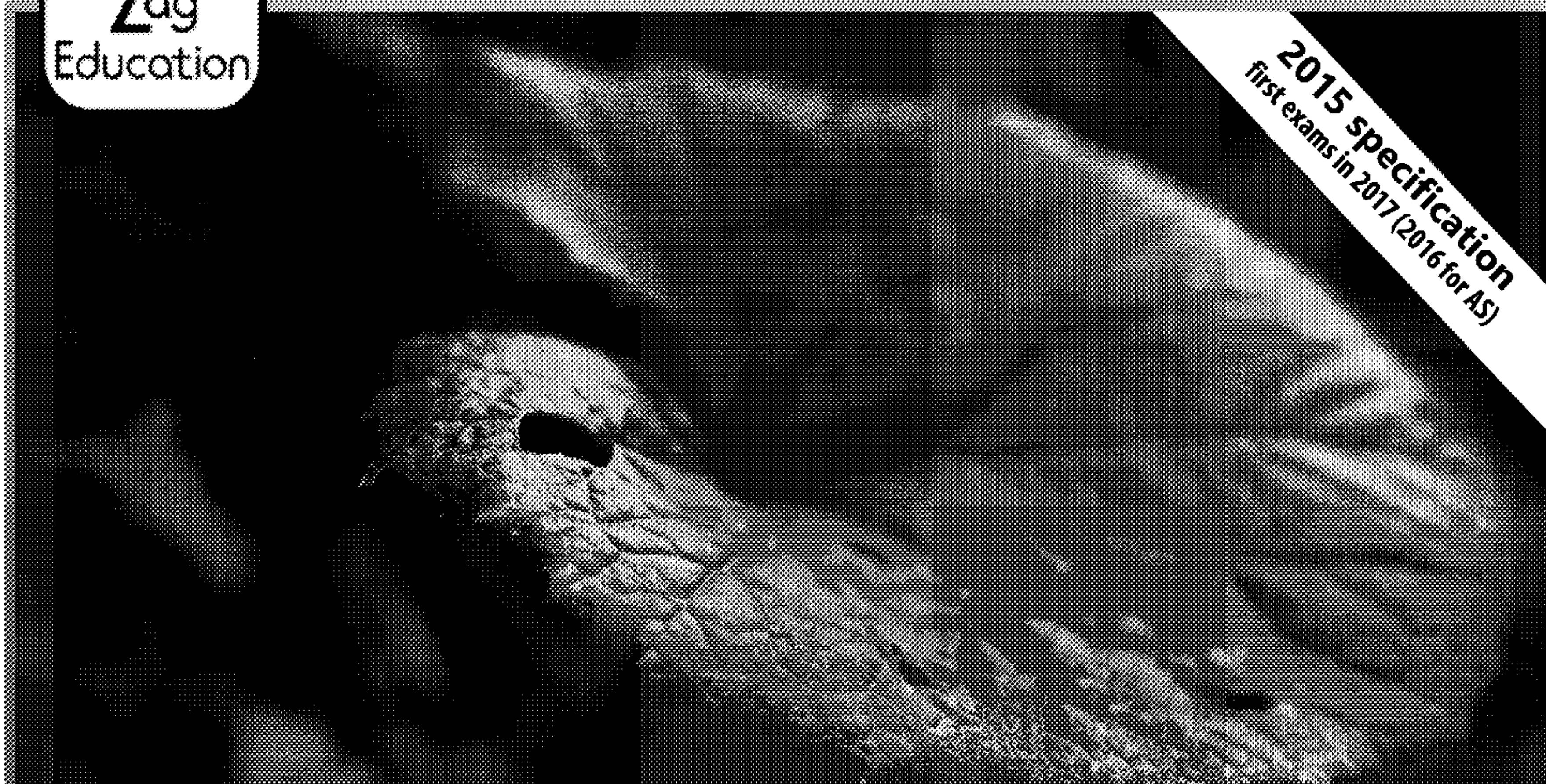
Biology AS / A Level Year 1 | OCR A | H020/H420



PowerPoints & Worksheets

for AS / A Level (Year 1) OCR A Biology

Module 3: Exchange and Transport

DD8/ 10472

POD 10472

zigzageducation.co.uk

Contents

Teacher's Introduction

This resource supports delivery and learning of OCR AS / A Level (Year 1) Module 3 (Exchange and Transport).

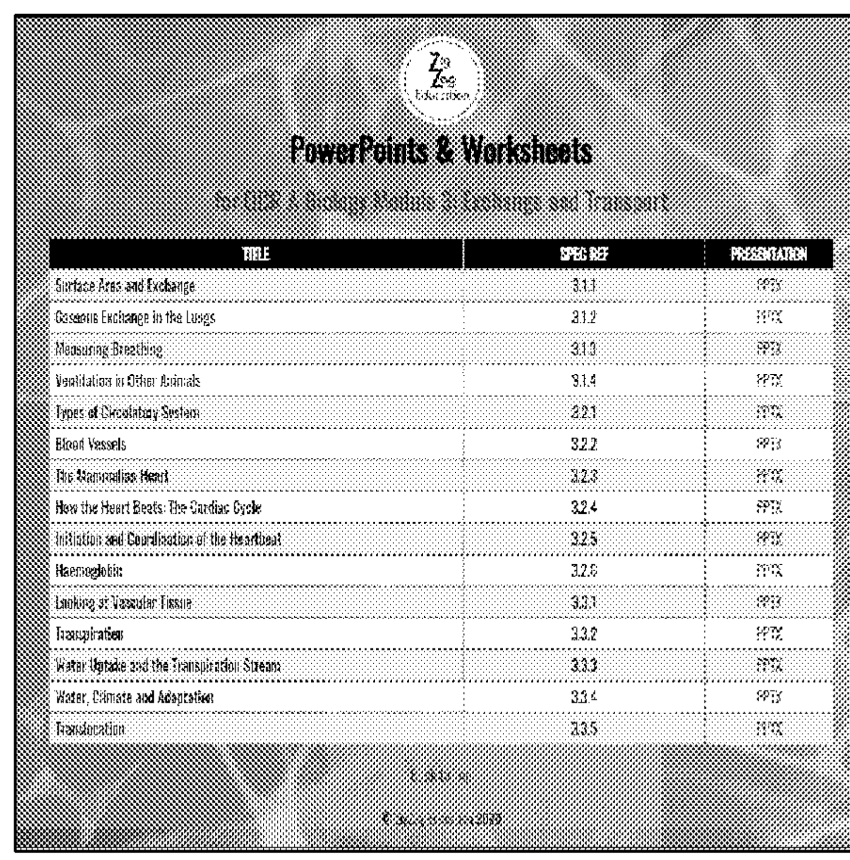
The prescribed theory is broken down into 15 topic areas:

3.1.1	Surface Area and Exchange
3.1.2	Gaseous Exchange in the Lungs
3.1.3	Measuring Breathing
3.1.4	Ventilation in Other Animals
3.2.1	Types of Circulatory System
3.2.2	Blood Vessels
3.2.3	The Mammalian Heart
3.2.4	How the Heart Beats: The Cardiac Cycle

3.2.5	Initiation and Coordination of the Heartbeat
3.2.6	Haemoglobin
3.3.1	Looking at Vascular Tissue
3.3.2	Transpiration
3.3.3	Water Uptake and the Transpiration Stream
3.3.4	Water, Climate and Adaptation
3.3.5	Translocation

For each of the topic areas listed above, there is the following:

1. A comprehensive PowerPoint presentation provided on CD, covering the topic theory. Packed with student-friendly notes, diagrams and images.
Providing easy access to the presentations is an HTML menu.
Tip: *copy the* <u>*Module3*</u> *folder from the CD to an accessible network location and provide a link/shortcut to the* <u>*index.html*</u> *file inside it.*



2. Matching worksheets designed to develop both understanding and application of the presentation content.
These worksheets feature a range of activities, including diagram labelling/annotation, definition matching and gap-filling exercises.

Answers for every worksheet, plus printed handouts for every presentation, are provided at the back of this resource.

October 2020

3.1 – Exchange Surface

3.1.1 – Surface Area and Excha

1. The following table contains five different sized-spheres, each representing a to work out the surface area, volume and surface area to volume (SA:V) ratio

surface area of a sphere = $4\pi r^2$

volume of a sphere = $\frac{4}{3}\pi r^3$

Radius (mm)	1	2	4
Surface area (mm^2)			
Volume (mm^3)			
SA:V			

2. In the table above, how has each measure been affected by size?

Surface area: ....

....

Volume: ....

....

Surface area to volume ratio (SA:V): ....

....

3. Using the data on size of spheres, suggest what effect an increase in size mig specialist exchange surfaces in larger animals.

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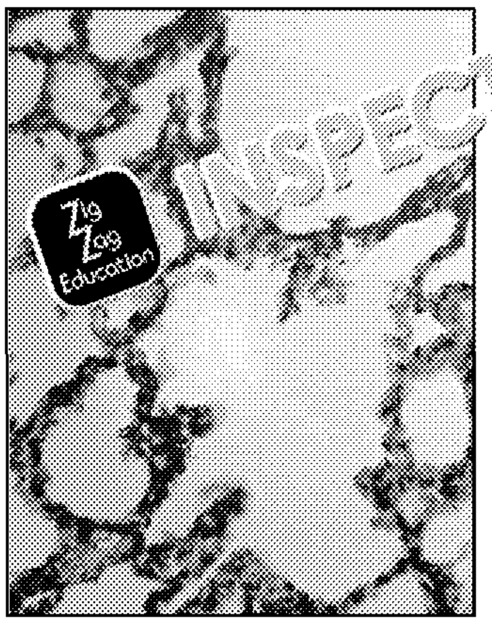
4. Fill in the gaps to explain how lung tissue is adapted to its function.

Lungs 	The lungs have a very large surface are __________ or air s are made of __________ which is __________ provides a short __________ Diffusion gradients are maintained be vascularised, i.e. they have a good ____ and they are ventilated, so waste ____ are removed and a concentration ____ is maintained.

5. Open Extension: choose an exchange surface which is not listed above – exa fish or the leaves of flowering plants

Research the exchange surface you have chosen, and explain how it is adapt

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3.1.2 – Gaseous Exchange in the L

1. List and describe the features of the human (mammalian) lung that make it a

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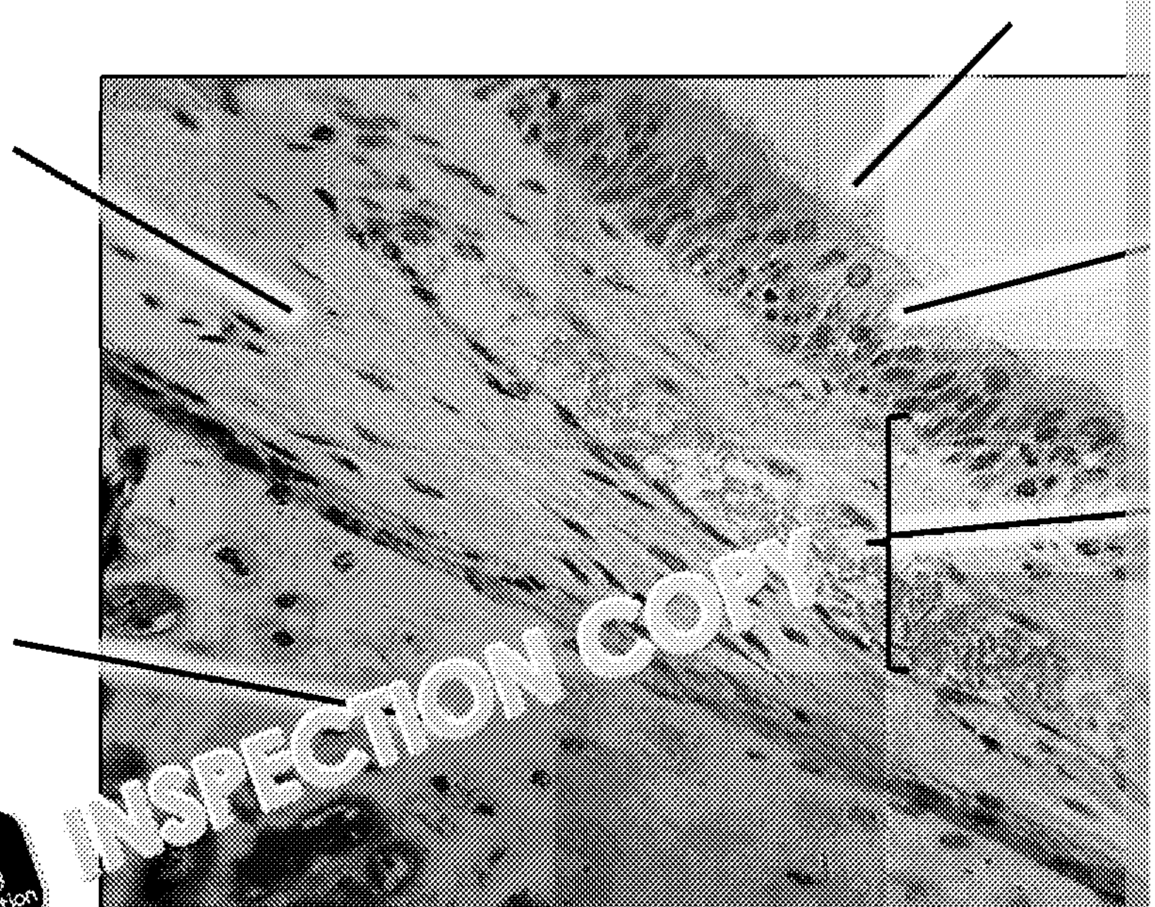
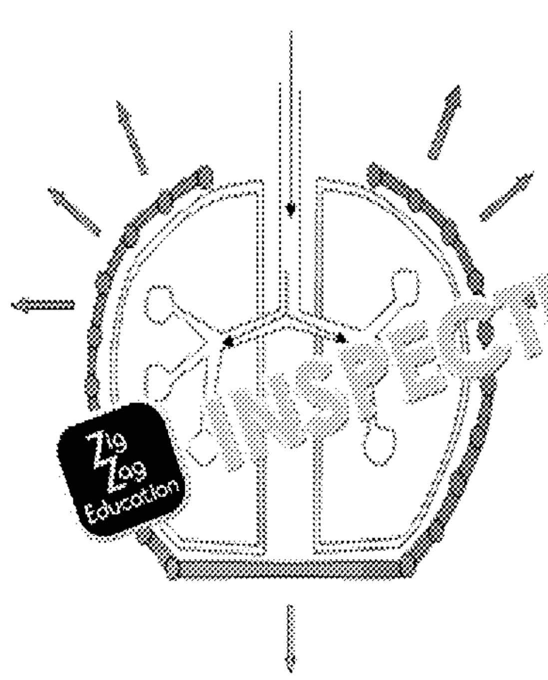
2. The following micrograph shows a section of trachea. Label it to show the ci cartilage, smooth muscle and elastic tissue / blood vessels.



3. Fill in the gaps to complete the paragraph.

Inspiration 	____________________ intercostal ribcage ____________________ and The diaphragm contracts, pulling it shape to a flattened shape. The combined effect of these actio • volume of the thorax and lungs • pressure is ____________________ lungs lower than atmospheric p • air enters, travelling down the

4. Suggest two reasons why it is important that alveoli are moist.

   1. ....

      ....

   2. ....

      ....

5. Extension: The bronchioles of a person with asthma have more smooth mus
   larger numbers of goblet cells.

   During an asthma attack, histamine is released by the bronchiolar epithelial
   contraction and mucus secretion. Suggest why this might cause difficulty in
   respiratory gases.

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3.1.3 – Measuring Breathing

1. Leah is an aspiring athlete. When measured at rest, she takes 11 breaths pe
ventilation rate is 6.05 $dm^3\ min^{-1}$. Calculate Leah's tidal volume.

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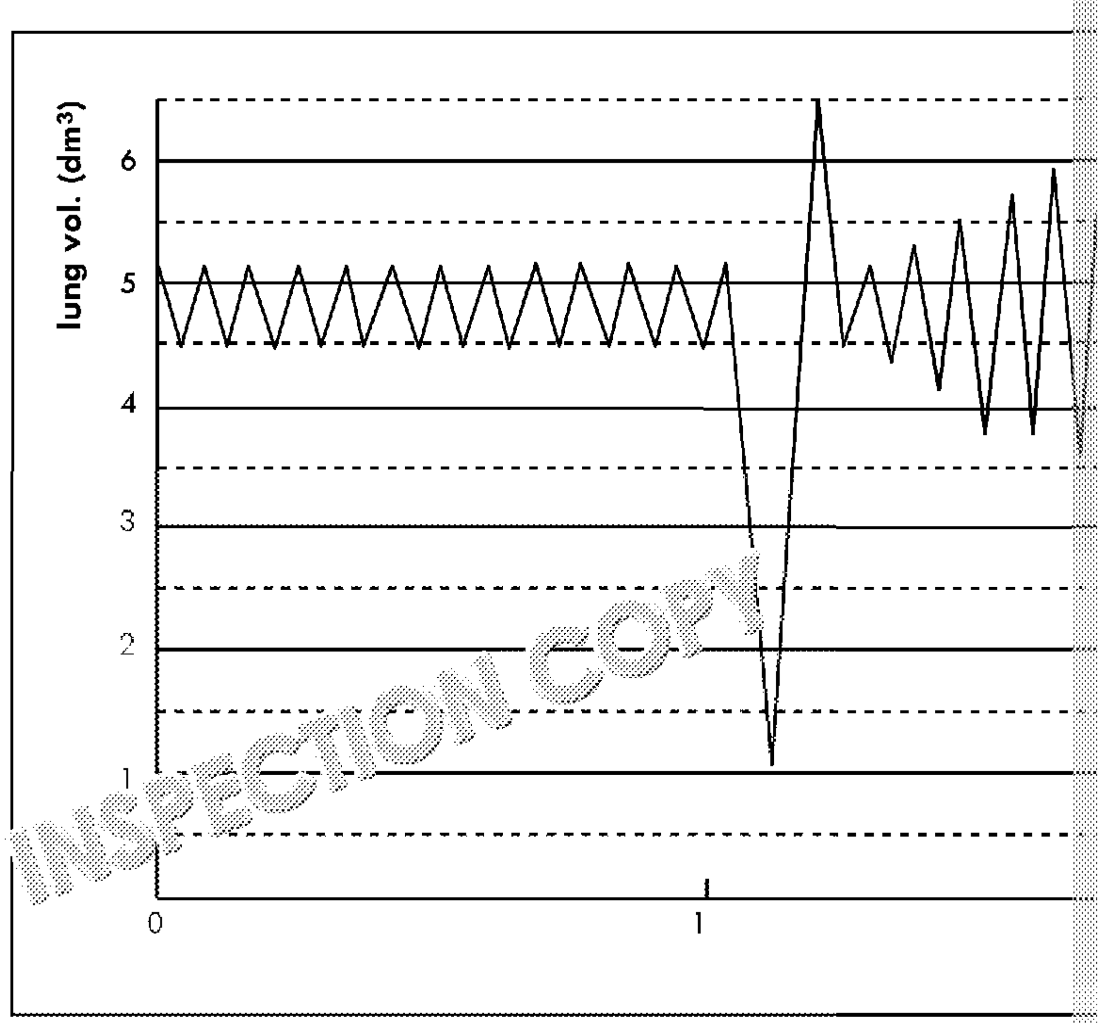
....

2. Complete the table to include lung volume terms and definitions.

Term	Definitior
	The amount of air exchanged in a singl 500 cm^3 (0.5 dm^3) a
Expiratory reserve volume	
	The additional volume of air that can be inh
Vital capacity	

3. Hasee xt orm student who has used a spirometer to measure his b
adapte ow lung volume over time.



Use the graph on the previous page to estimate:

i) Haseeb's tidal volume.

....

ii) Haseeb's vital capacity.

....

iii) Haseeb's breathing rate (a' ' ' ').

....

4. How is oxygen consumption visible on a kymograph?

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5. Extension:

i) Some of the inhaled air does n... ...lly reach the exchange surfaces ... explanation for this.

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ii) Bearing in mind your answer to question i), suggest why there is a limit ... used by swimmers.

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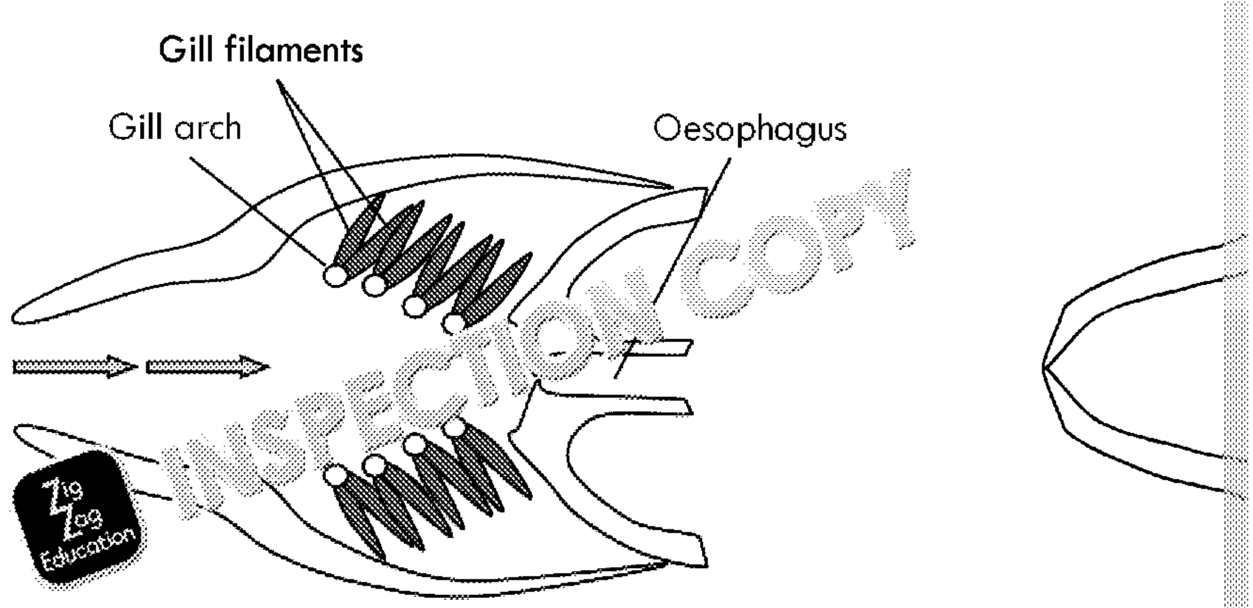
3.1.4 – Ventilation in Other Ani

1. Summarise the key features that make the gills of a bony fish efficient at ga

2. Annotate the diagram to explain what is happening and how pressure is cha



3. Match the terms to the definitions. Two of the terms have no definition. W unpaired terms.

Tracheole	Bony flap at the back of a and aids the pr
Operculum	A pore in the skin of an in closed to contro
Chitin	Many of these protrude fr area for g
Ventilation	Ensures that blood alw relatively m
Spiracle	The tough glucose po exoskeletons (a
Countercurrent flow	
Gill filament	

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4. Open Extension: Many scientists think that the tracheal system limits the m Research this topic and write a couple of paragraphs. (Consider: have insect

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3.2 – Transport in Anima

3.2.1 – Types of Circulatory Syst

1. Explain in detail why a mammal requires a more complex and efficient circul

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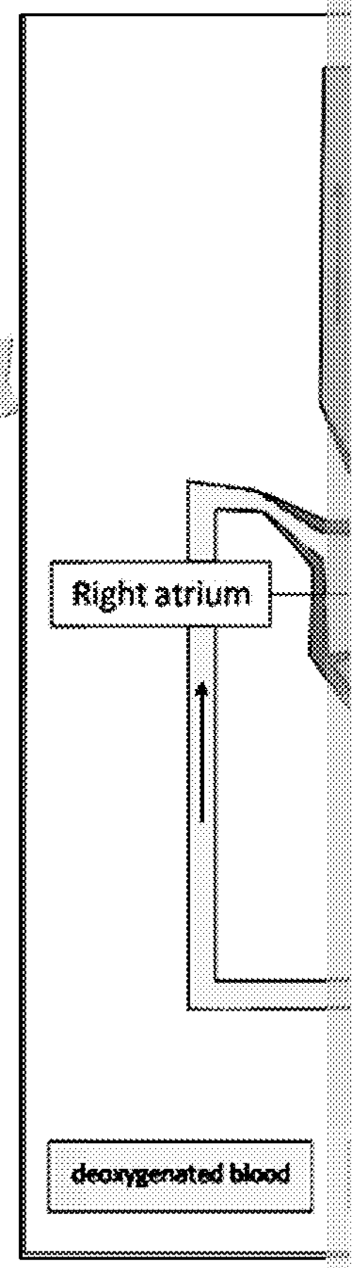
2. Fill in the gaps to complete the paragraphs.

Organism	Type of System	Brief Description
Fish		The heart has a single ______ ventricle. Blood is initially pumpe ______ where i ______. It then the body at ______ heart as ______ inefficient, but meets the energy n
Primate		There is separate circulation to the (______ circula ______ circula repressurised in the ______ ______ so that i to tissues and organs.

3. The diagram to the right shows an amphibian's partial double circulatory system.

Study the diagram, and explain how it is similar to and different from a typical double circulatory system.



4. Open Extension: Although octopuses have a closed circulatory system like hu from the human system. Research the octopus circulatory system, and outline

3.2.2 – Blood Vessels

1. Fill in the table to compare the different types of blood vessel.

Property	Arteries	Veins
Direction of flow		
Blood pressure		
Layers and structure		
Lumen width (relative)		
Valves		

2. Arteries *nearly* always carry oxygenated blood. Which artery provides the ex

....

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3. Identify two reasons why capillaries are so narrow.

- ....

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- ....

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4. Suggest why veins need valves.

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5. Match the word/phrase to the definition (two of the words/phrases have no

Blood pressure	This force pushes outwards to leave
Oncotic pressure	This is made mostly out of walls of arter
Plasma	This force pushes inwards o to return t
…c tissue	The components of the blo and may potentiall
Muscle tissue	All the liquid components dissolved substances su
Lymph	
Tissue fluid	

6. Why are some white blood cells found in the tissue fluid but no red blood ce

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7. Extension: A patient with atherosclerosis has calcified, hardened patches in reduce elasticity. Suggest the effect that this might have, and why it is a pa

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3.2.3 – The Mammalian Hear

1. Explain why:
   i) Cardiac muscle fibres have many mitochondria.

   ……………………………………………………………………………………

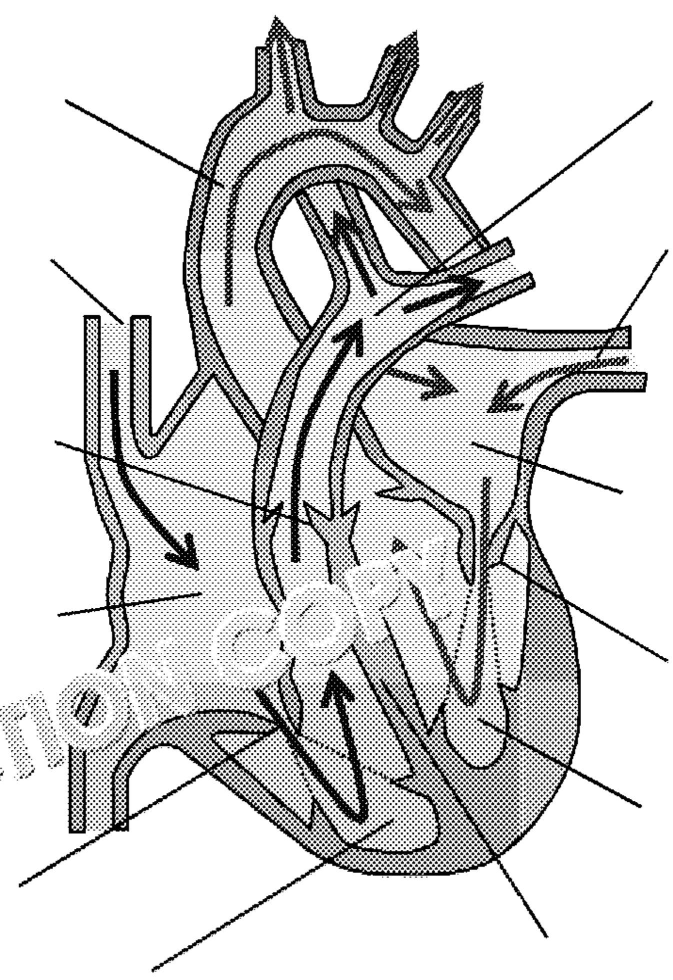
   ……………………………………………………………………………………

   ii) The left ventricle has a [illegible] than the right ventricle.

   ……………………………………………………………………………………

   ……………………………………………………………………………………

2. Label the diagram to show the heart's components and the blood vessels co



3. Describe the purpose of the atrioventricular valves.

……………………………………………………………………………………

……………………………………………………………………………………

4. Compared to other valves in the blood vessels, what is unusual about the se

……………………………………………………………………………………

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5. Extension: Suggest adv[illegible] of cardiac muscle being myogenic, but also c and hormone sy[illegible]

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3.2.4 – How the Heart Beats: The Car

1. Why is the heart described as a double pump?

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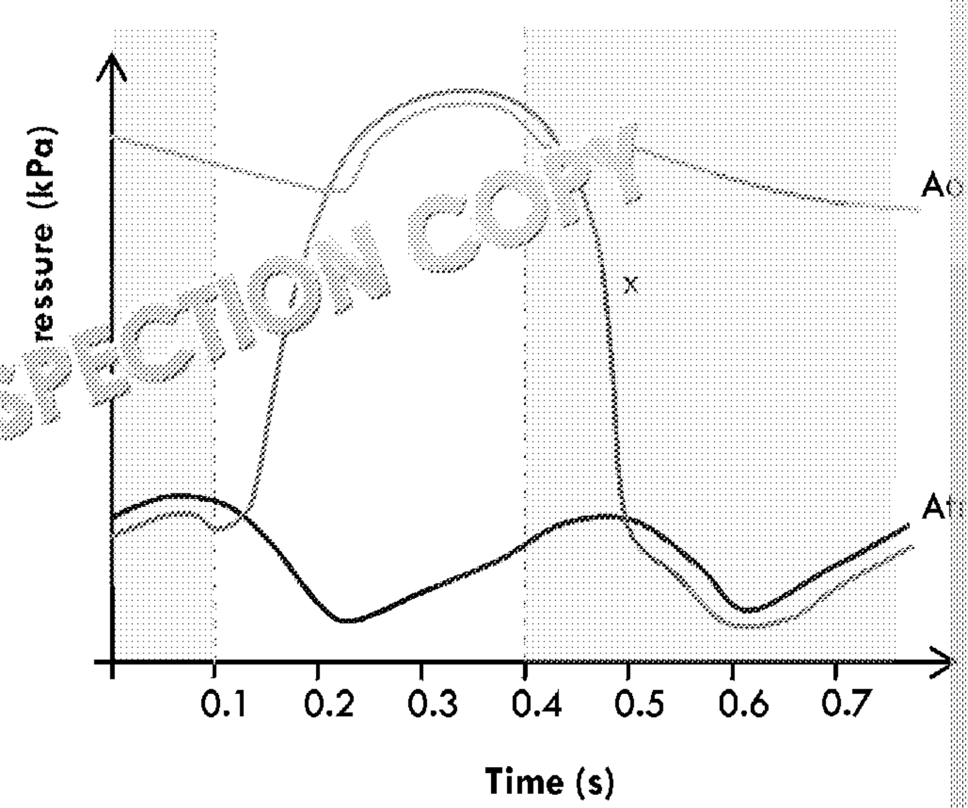
2. Below is graph of cardiac pressure in the left side of the heart.
   i) What is reflected by line x?

   ....

   ii) Annotate the graph to show a place where: a semilunar valve opens, th the atrioventricular valves close.



3. Why does the aorta start to increase in pressure some time (0.1 s) after the v

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4. Describe the process of events that occurs during diastole.

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5. The trace on the pr... ...ge shows one full cardiac cycle for a patient. Ho patient'... ...rt ... ...one minute?

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6. Extension: Suggest ways in which a cardiac cycle graph for the right side of t from a cardiac cycle graph from the left hand side of the heart.

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3.2.5 – Initiation and Coordination of th

1. Why is it important that:

   i) The wave of excitation spreads rapidly through cardiac muscle?

   ....

   ....

   ii) The spread of excitation is delayed between the atria and the ventricles

   ....

   ....

2. Explain, using diagrams, why the atria and ventricles are stimulated to contr

3. Define these words:

   Myogenic: ....

   ....

   Cardiac cycle: ....

   ....

4. Match the heart condition to the description of a patient.

None (Normal ECG)	Resting heart rate c potentially danger Smokes 10 ci
Bradycardia	Patient is suffering f dizziness and severe having a
Ec pic heartbeat	Resting heart rate of medication and suffering ener
Fibrillation	Resting heart rate of 55 bp coming in for a
Tachycardia	Resting heart rate of coffee drinker. Electro 'ext

5. Extension: An artificial pacemaker helps con rol h rhythm of the heart. Su imitates, and how it could achieve t'...

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3.2.6 – Haemoglobin

1. Fill in the gaps to complete the paragraph.

Haemoglobin is a pigment found in mammalian blood that has an importa

____________________ gases – oxygen and carbon dioxide. Each haemog

____________________ haem groups, each of which is capable of binding

Where oxygen levels are high (such as in ____________________ tissue), t

combines with oxygen. In areas such as respiring muscle where oxygen co

oxygen ____________________ from the haem group – this is increased b

dioxide, a phenomenon known as the ____________________ ________

dioxide produced during respiration diffuses into the red blood cells, formi

dissociates producing hydrogen ions and ____________________ ______

is catalysed by the enzyme ____________________ ________________

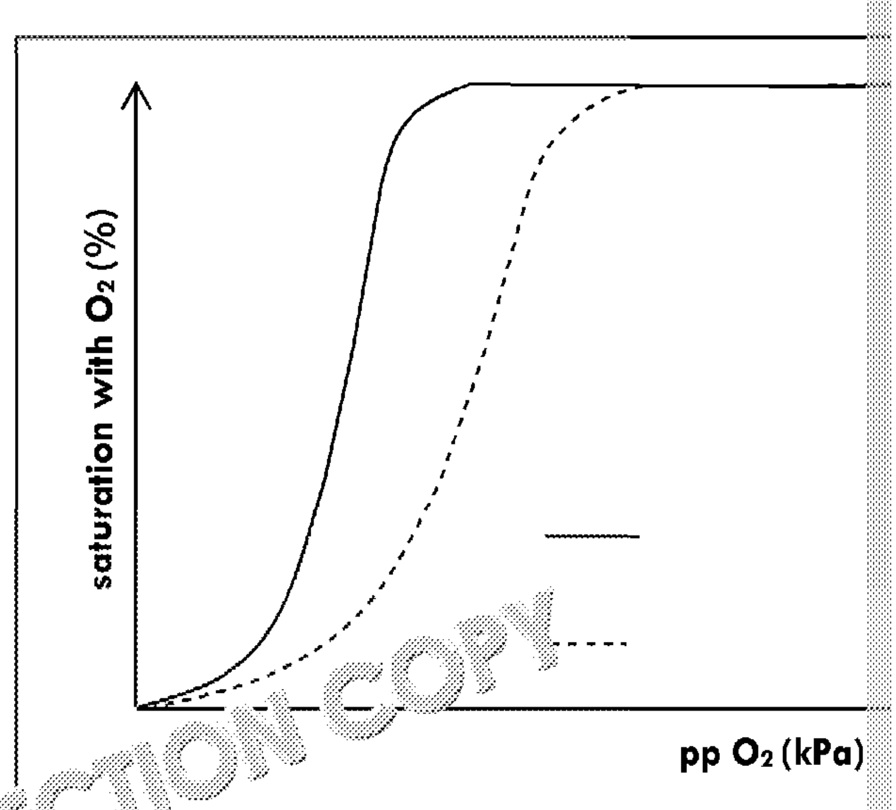
combine with haemoglobin to form ____________________ ________

oxygen. This has the effect of increasing oxygen release from haemoglobi

Another benefit is that the haemoglobin removes the hydrogen ions from t

____________________ and so preventing a fall in pH.

2. The two curves show haemoglobin's affinity for oxygen in muscle tiss
resting state. Label the graph to show which is which, and explain your a



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3. If a mother's haemoglobin had the same dissociation curve as fetal haemogl
a problem?

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4. If the chloride shift didn't occur, what effect would this have on the blood?

....

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....

....

5. Draw a chemical equation to show how carbon dioxide and water become ca
dissociates into ions.

....

6. Extension: Myoglobin is a pigment which can be found associated with oxyg

Study the disassociation curve below and suggest the role of myoglobin.

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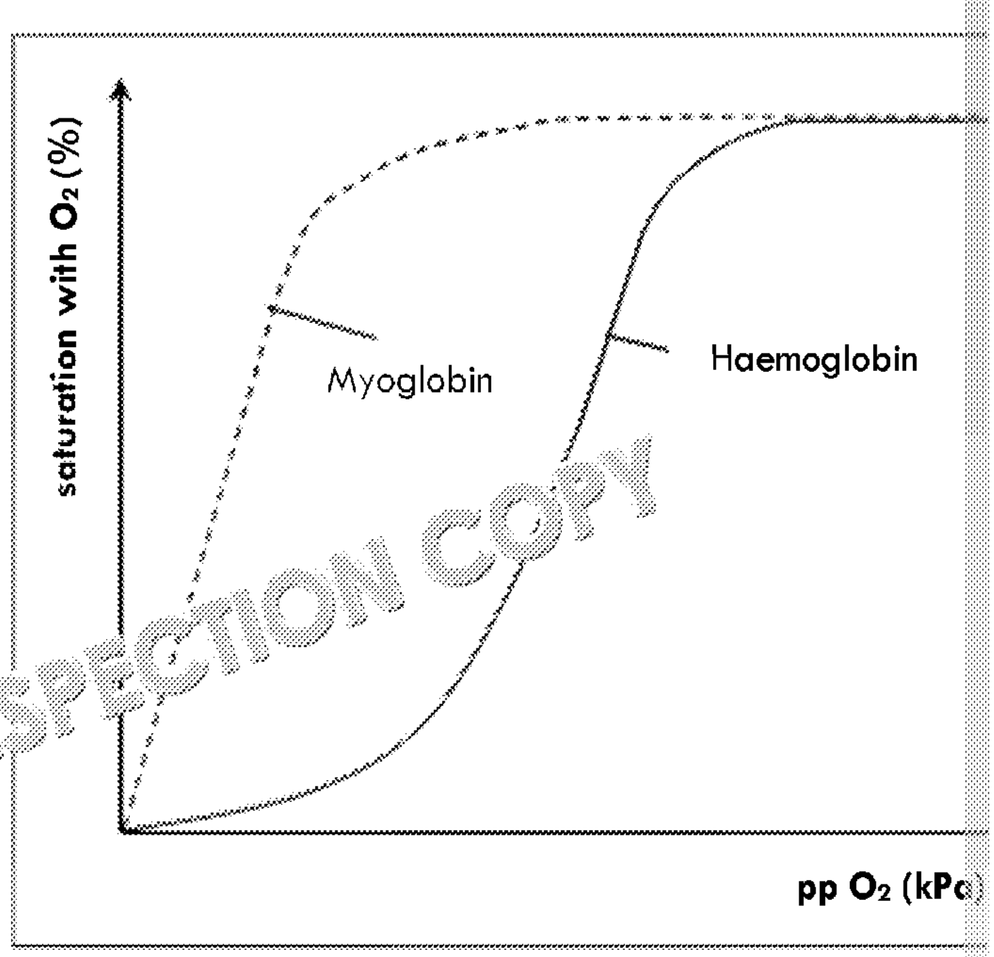

3.3 – Transport in Plant

3.3.1 – Looking at Vascular Tis

1. Which properties of water are important in keepi... r flowing through t

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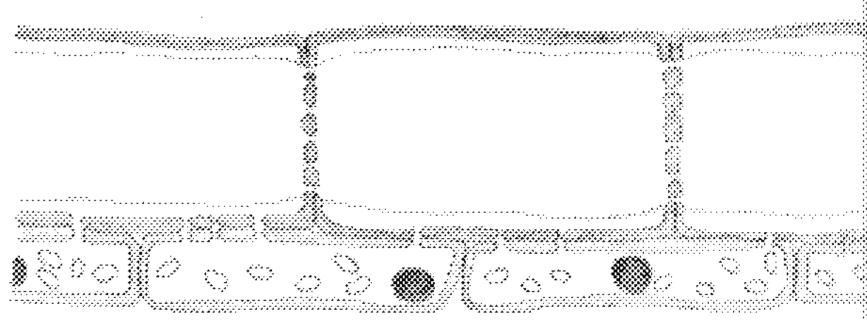
2. Label the structure of the phloem vessel. Include the following terms: sieve
companion cell.



3. Complete the table to compar... phloem tissues.

	Xylem	
Structure		
End cell walls		
Active or passive transport?		
Substances transported		

4. Open Extension: Lo... gram of vascular tissue in the stem on the p
which yo... stem to study which substances are transported in t
are tra...ed in the phloem.

....

....

....

3.3.2 – Transpiration

1. If stomata increase water loss from transpiration, why do most leaves open t
part of the day?

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....

....

2. Draw a mind map to show plant adaptations to reduce water loss from trans

3. During ... season in tropical countries, transpiration can fall to very lo

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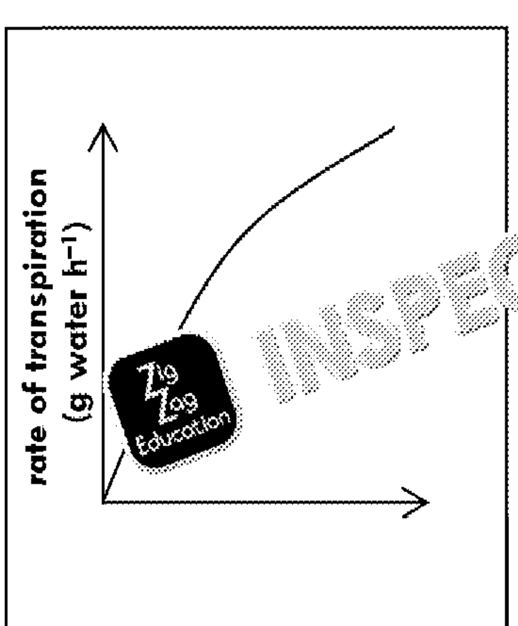
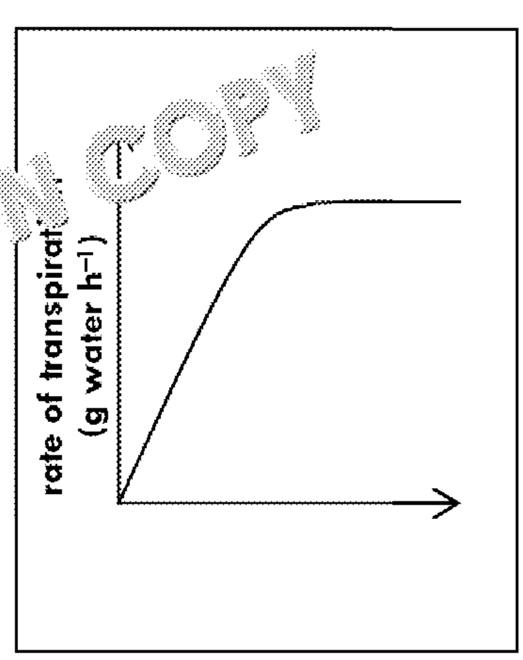
4. Label the axes to show which graph shows how transpiration is affected by: l
wind speed. Explain your answers.





5. Explain why the layer of oil is used in the simple beaker potometer.

6. Suggest why it is advisable to repeat measurements of water uptake.

7. Extension: In several ways, plants must balance their need to reduce water l
photosynthesis. Suggest some ways in which plants experience and manag

3.3.3 – Water Uptake and the Transpirat

1. State two properties of water that make transpiration possible (even in very

....

....

2. Why is it important that a continuo... m of water is maintained in the xy

....

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....

3. Match the term to the definition (two of the terms do not have matching de

Term	Definition
Endodermis	Pathway which water tak between the cytoplasm an
Medulla	A band of waxy hydropho which controls water's rout
Apoplast	P... ay which water tak between the cell w
Casparian strip	The centre of the root, whi othe
Vacuolar	The outer part of the root once it is taken up
Cortex	
Symplast	

4. i) Draw a diagram which includes a root hair cell, at least one cortex cell a how water travels through the root.

   ii) O... diagram, label the Casparian strip, and draw arrows to show th vacuolar pathways.

5. Open Extension: Create a poster to show the overall process of water move the root, stem and leaf.

3.3.4 – Water, Climate and Adapt

1. Fill in the table to compare and contrast the adaptations of xerophytes and h

	Xerophytes	
Stomata		
Leaf [illegible]/number		
Roots		

2. Why do both xerophytes and hydrophytes have a thick waxy cuticle, when th climatic environments?

....

....

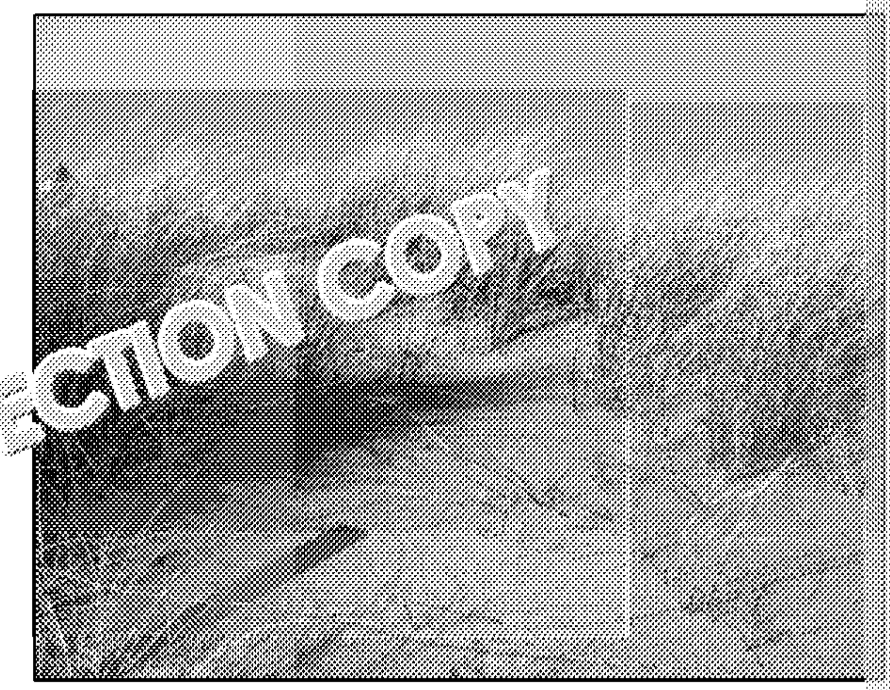
....

....

3. Fill in the gaps to complete the paragraph.

> Because xerophytes (e.g. cacti) are at risk of drying out due to the ______
>
> close their __________________ during the day and open them at night.
>
> __________________ and respiratory gases throughout the day. They a
>
> at *night*, and using a process called __________________ acid metabolis
>
> four-carbon organic acid called malate.
>
> __________________ (e.g. water lilies) which are adapted to __________
>
> have trouble getting enough __________________ and respiratory ga
>
> by having __________________ tissue, containing air-filled spaces which
>
> diffuse into submerged tissues.

4. Marram grass (below) is common on sand dunes. During windy conditions, i sheltering the lower surface of the leaf.



i) Explain why folding leaf blades inwards reduces transpiration.

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....

ii) A hypothetical mutation causes marram grass to fold its leaves outward mutation not thrive?

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5. Extension: Some plants show xerophytic adaptations yet they live in enviro apparently plentiful, such as on the seashore. Give two reasons for this.

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3.3.5 – Translocation

1. Complete the following description of the mass flow theory.

Movement in phloem depends upon pressure differences between ______

____________________. Energy has to be used to generate these pressure

transport is ____________________. In sources such as photosynthesising l

____________________ concentration. Sucrose is actively loaded into phlo

solute concentration of phloem sap and so reduces its ________________

(ψ). As a result of this, water flows ____________________ a water potenti

phloem. In sinks such as roots, fruits, bulbs and tubers, sucrose is removed

respiration). As the sucrose is removed, water follows it by ____________

____________________ difference between the source and sink and so cau

to sink, taking solutes along with it (hence ____________________ ______

be anywhere in the plant, so phloem sap can flow either up or down (but no

sieve tube).

2. Give *three* ways in which sieve elements are adapted to their role in transloc
cytoplasm, plasmodesmata.)

- ....
- ....
- ....

3. Suggest what might happen to translocation in an average plant if the temp
20 °C to 30 °C, if the temperature was increased from 20 °C to 60 °C, or if a r
into phloem tissue.

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4. Would these changes have similar effects on transport in xylem? Explain.

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5. Extension: Ringing a tree (as done by hungry deer) means removing a horizo
outer layer of cortex and bark. This causes the death of the tree. Explain wh

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Answers

3.1.1 – Surface Area and Exchange S

1.

Radius (mm)	1	2	4
Surface area (mm^2)	12.6	50.3	201
Volume (mm^3)	4.19	33.5	268
SA:V	3:1	1.5:1	0.75:1

2. Surface area: the surface area has increased by × 100 from the smallest to the la

   Volume: the volume has increased by × 1000 from the smallest to the largest sp

   Surface area to volume ratio (SA:V): therefore, the SA:V ratio is reduced to one

3. Larger organisms would tend to have a lower surface area to volume ratio, whic which diffusion has to take place. Because these organisms also have higher m across the organism's external surface would not be efficient enough to fuel th Therefore, a specialised exchange surface with a large surface area and short di

4. alveoli, [illegible] diffusion, blood supply, products, gradient

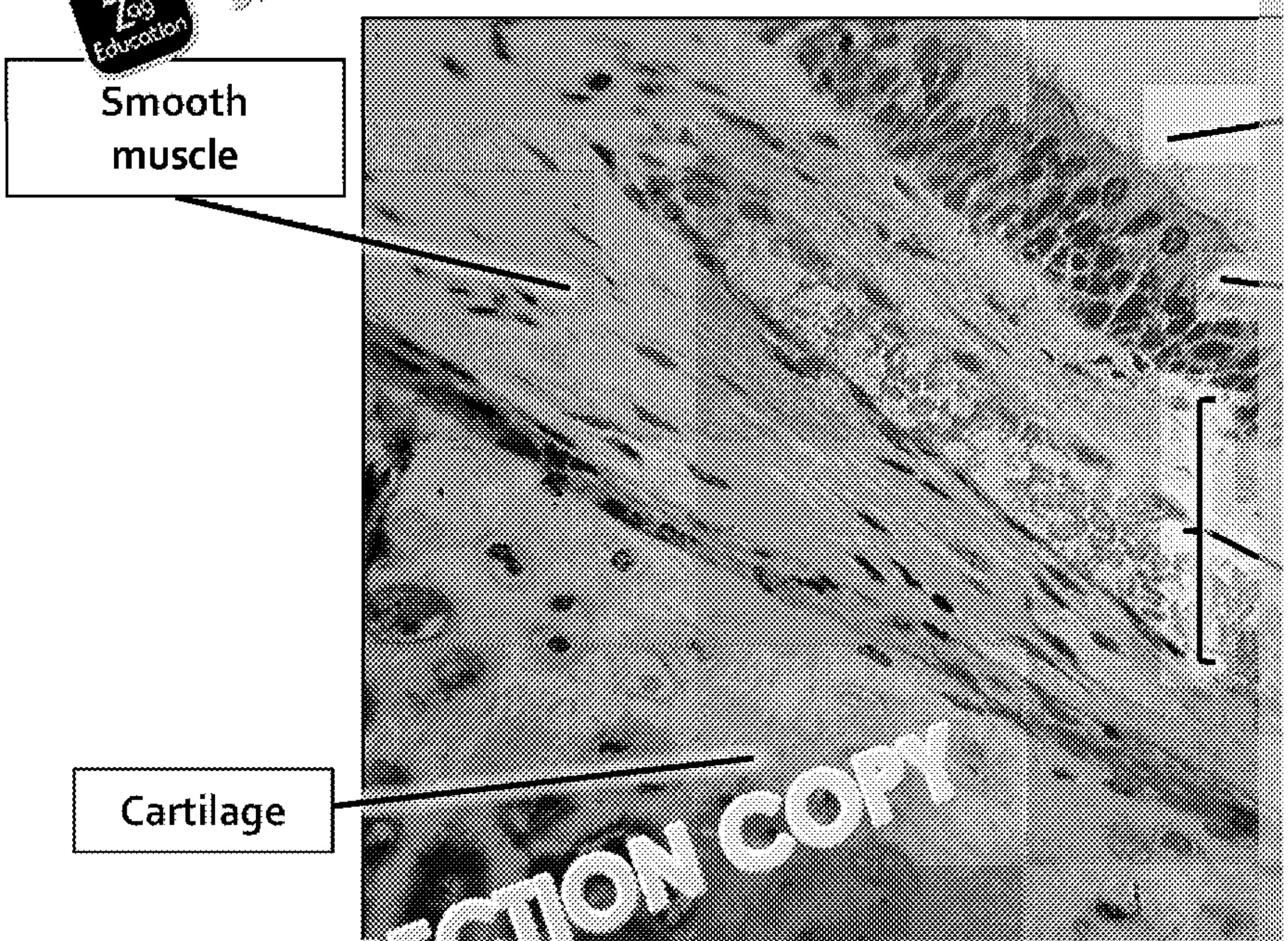
3.1.2 – Gaseous Exchange in the L

1. Large surface area compared to the surface area of the body.

   Short diffusion path – alveoli and capillaries are made from squamous epitheliu
   so are made from a single layer of cells (one cell thick) and combined thickness i

   Lungs are vascularised with capillaries in very close proximity to the alveoli. Hel
   gradients – blood supplied to the lungs is low in O_2 and rich in CO_2.

   The lungs are well ventilated. This helps maintain concentration gradients.

2. 

3. Extern[illegible], outwards, domed/arched, increases, lowered

4.
   - The layer of moisture helps to prevent the alveoli from collapsing.
   - Moisture is required to dissolve oxygen so that it can be absorbed into the b

5. The smooth muscle contracting would reduce the diameter of the bronchi and b
   difficult for air to get through. At the same time, mucus is a thick, viscous subst
   through mucus than through the air. The excess constriction and large amount
   the lungs of oxygen while CO_2 is not removed.

3.1.3 – Measuring Breathing

1. Breathing rate = 11 breaths per minute (min^{-1})

   Pulmonary Ventilation rate = 6.05 $dm^3 \, min^{-1}$

   Tidal volume × breathing rate = p.v.r.

   ∴ Tidal volume = p.v.r. / breathing rate

   Tidal volume = 6.05 / 11

   Tidal volume = 0.55 [illegible]

2.

Term	Description
Tidal volume	The amount of air exchanged in a single 500 cm^3 (0.5 dm^3) a
Expiratory reserve volume	The additional volume of air that can be exhal
Inspiratory reserve volume	The additional volume of air that can be inha
Vital capacity	This is the maximum volume of air that can b (typically between 4 –

3. i) 0.6 dm^3

   ii) 5.4 dm^3

   iii) 12 breaths per minute

4. Oxygen consumption is visible on a kymograph because the trace line graduall oxygen is used up. The gradient of the line can tell us how much oxygen is used

5. i) This volume (the dead space) is the volume occupied by the trachea, bronc bronchioles, which are filled with air. As the dead space is around 150 cm^3, breath does not actually reach the exchange surface.

   ii) The volume of the snorkel has to be added to the dead space (volume of th proportion of each breath does not reach the exchange surface.

3.1.4 – Ventilation in Other Anin

1. They have a very large surface area (four pairs of gills, each comprised of many gill plates).

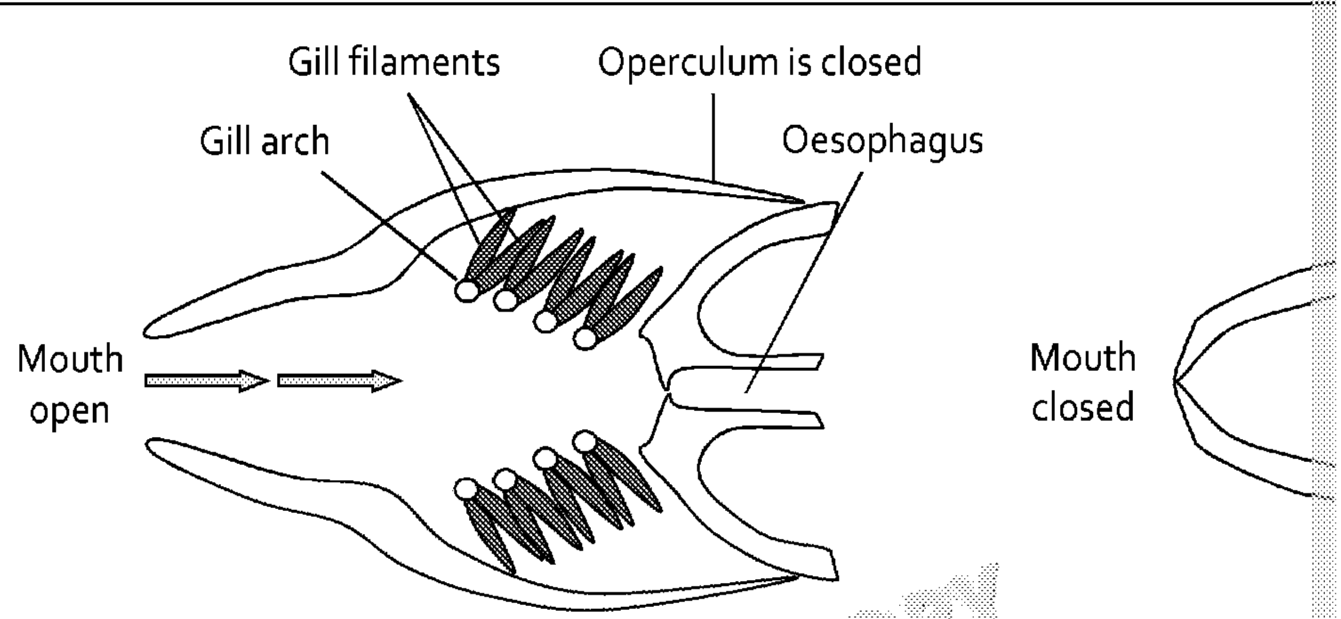
   They are thin – gill plates are about 10 µm thick and consist of two epithelial lay through which blood flows.

   They are vascularised (see above).

   They are ventilated (ram ventilation at its simplest, but can involve movement o firstly draw water into the mouth and then force it over the gills in the gill cavity

   There is countercurrent flow in the gills so that water and blood flow in opposite encounter water with higher O_2 concentration, so maintaining the concentratio

2.



The mouth opens; since the buccal cavity volume increases, the pressure within the cavity drops and so water is pulled into the mouth.

The mouth closes, and The volume of the bu placed on the water. V operculum, crossing th the bloo

3.

- Tracheole
- Operculum
- Chitin
- Ventilation
- Spiracle
- Countercurrent flow
- Filament

- Bony flap at the back of a and aids the pr
- A pore in the skin of an in closed to contro
- Many of these protrude fr area for g
- Ensures that blood alwa relatively m
- The tough glucose pol exoskeletons (a

Tracheole – a small permeable vessel in an insect's respiratory system, which c

Ventilation – the process of obtaining respiratory gases by moving air across a lungs or gills.

3.2.1 – Types of Circulatory Sys

1. Mammals are endothermic (warm-blooded). This means that they need to use maintain their body temperature at a constant level, carrying out metabolic pro in cold conditions, and also taking measures to cool down when it is very hot. Th respiration, which means tissues need to receive oxygen and nutrients at a faste an ectothermic animal.

2.

Organism	Type of System	Brief Description
Fish	Single, closed	The heart has a single <u>atrium</u> and a s pumped to the <u>gills</u> where it receive onwards to the rest of the body at lo heart as <u>deoxygenated</u> blood. The s but meets the energy needs of the fi
Primate	Double, closed	There is separate circulation to the l and to the body (<u>systemic</u> circulatio repressurised in the <u>left ventricle</u> so efficiently to tissues and organs.

3. Amphibians have two atria, like animals with a full double circulatory system – th deoxygenated blood from the body, while the left atrium receives oxygenated b surfaces (skin and lungs).

However, unlike mammals, amphibians have only one ventricle. Blood from bo which distributes blood via a forked aorta to both the body and gas exchange su fully double circulatory system, in which the ac[illegible] pumps blood to the rest

Oxygenated and deoxygenated blood are mixed in the ventricle and, conseque not fully oxygenated – this differs from a full double circulatory system in which travels to the body.

3.2.2 – Blood Vessels

1.

Property	Arteries	Veins
Direction of flow	Away from the heart	Towards the heart
Blood pressure	High (10–16 kPa)	Low (1 kPa)
Layers and structure	Thick outer layer with collagen and elastic tissue; thick middle layer of smooth muscle, inner layer of endothelium	Thinner layers than arteri with the same structure c collagen and elastic tissu smooth muscle; endotheli
Lumen width (relative)	Narrow (relative to thick walls)	Wide
Valves	Only in the pulmonary artery and aorta	Present in all veins

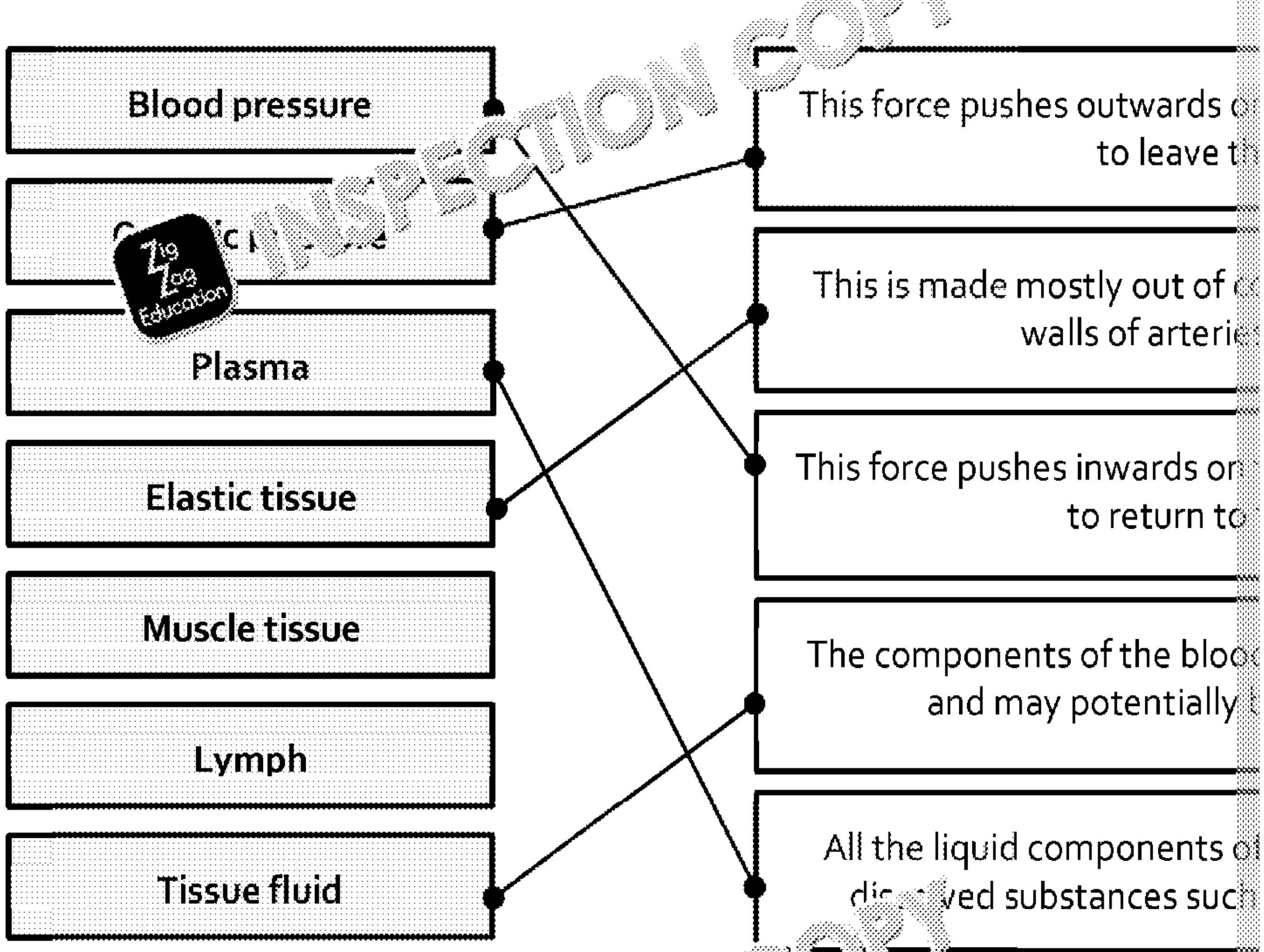
2. The pulmonary artery carries deoxygenated blood from the heart towards the lu and shed CO_2.

3. Capillaries are narrow so that red blood cells are pressed against their walls – th across which oxygen must diffuse to leave the vessel and form tissue fluid.

   There are a huge number of capillaries, and they must fit into tiny gaps between tissues receive a steady supply of oxygen and nutrients.

4. Veins need valves to prevent blood from flowing backwards, because it is at rela isn't a strong pulsing force from the heart to keep it flowing forwards.

5.



6. White blood cells are found in the lym[illegible] lymph is created from excess t cells are small enough to pass [illegible] the fenestrations in capillaries and form t are too large and do [illegible] blood vessels.

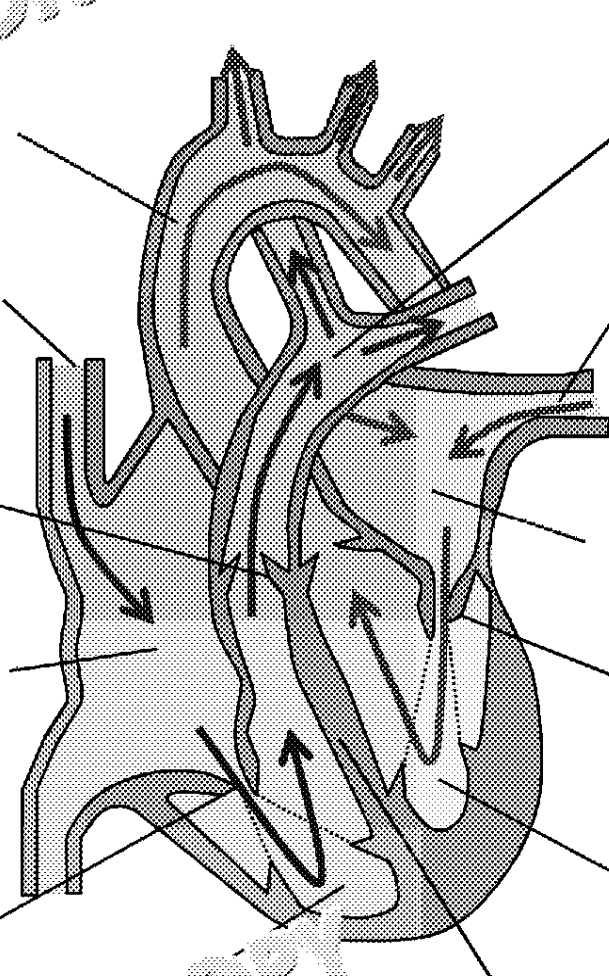
7. Reduc[illegible] means that the vessel does not recoil as effectively from the blood f[illegible] heart. The arteries would be at more risk of rupturing due to the arteries are more vulnerable to rupture, because blood moves unevenly in pulse they are placed under higher pressure than capillaries or veins.

3.2.3 – The Mammalian Hear

1. i) The cardiac muscle has a powerful contraction, and is constantly active du requires a large amount of energy, which is provided by mitochondria in th

   ii) The left ventricle has to pump oxygenated blood at a higher pressure into t existing pressure within the blood vessel.

2.



3. They p... bl... flowing back into the atria when the ventricles contra

4. The semilunar valves are found in arteries, while all other blood vessel valves ar

5. At rest, the cardiac muscle is able to contract in a highly regular pattern, becau control. This means that changes or problems elsewhere in the body, such as d system, will be less likely to stop the heartbeat or make it irregular. Internal co to communicate with the brain via nervous signals before each heartbeat.

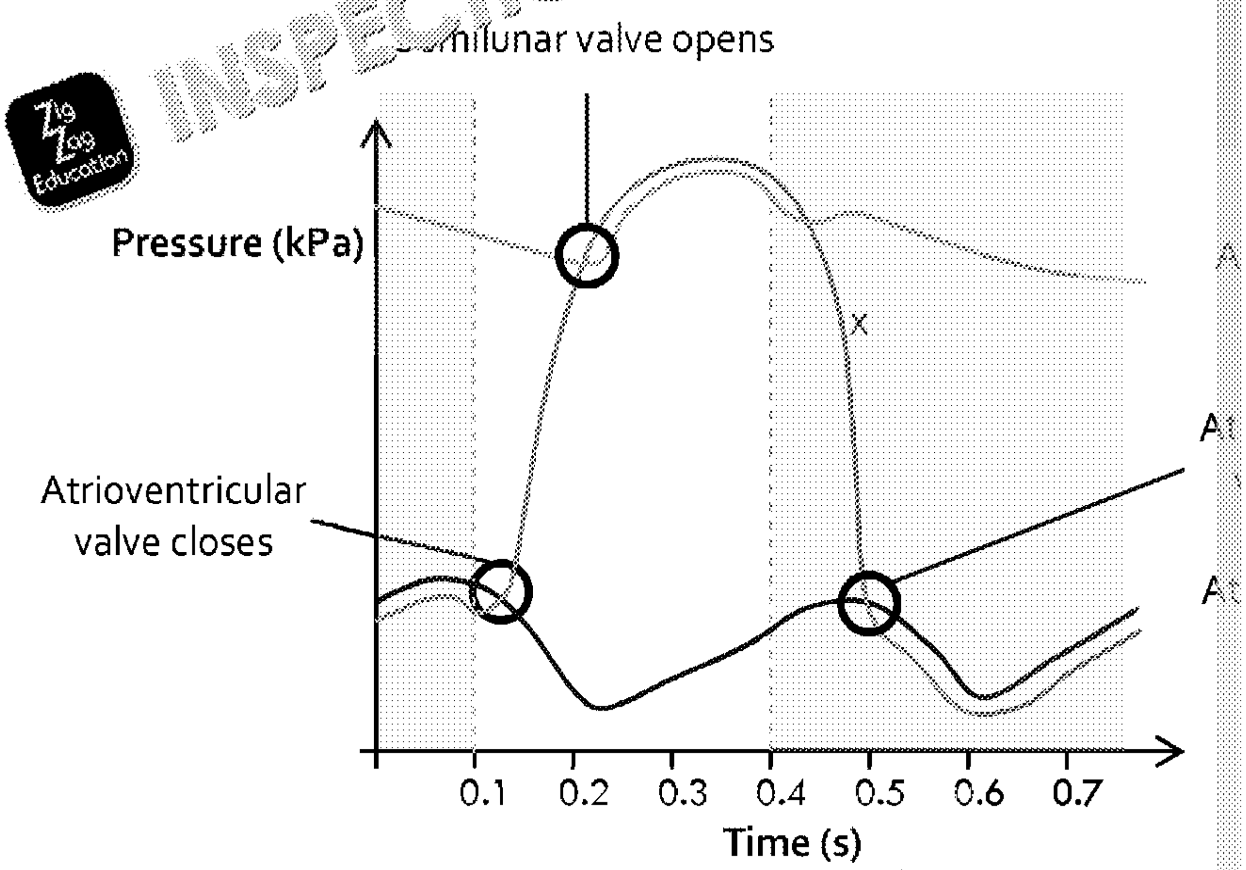
   However, some external control by the sympathetic and parasympathetic nervou For example, the sympathetic nervous system can raise the heart rate in respons as adrenaline can create a fight-or-flight response, where the heart rate increases

3.2.4 – How the Heart Beats: The Car

1. It pumps blood to the lungs and the rest of the body simultaneously, from the r respectively.

2. i) Ventricular pressure

   ii)



3. Initially, the pressure in the left ventricle is still lower than the pressure in the a pushed closed by the aortic pressure. It is only when the ventricular pressure e semilunar valve opens and the pressurised blood flows into the aorta.

4. The heart muscle relaxes, causing the pressure in the ventricles to drop sharply a again, preventing backflow of blood from the aorta. Once the ventricular pressu atrioventricular valve opens, and blood that has been gradually filling the left at ventricle. Initially the pressure decreases, but as the heart fills with blood, press

5. One cycle = approximately 0.8 s

   One cycle = one full heart beat

   One minute = 60 s

   Heartbeat = 60/0.8 = 75 bpm (beats per minute)

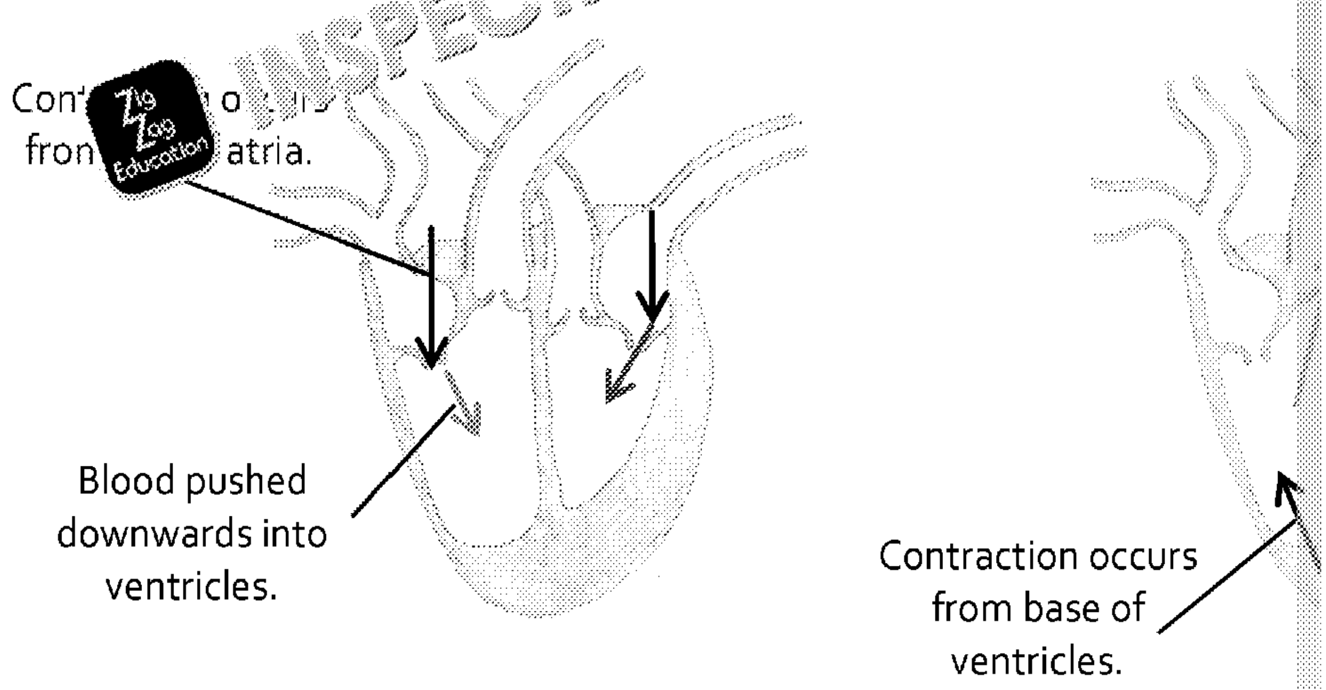
6. There would be no line for the aorta – instead, blood flows into the pulmonary ar less pressure than the left ventricle, because it is pumping deoxygenated blood a distance (to the lungs rather than around the whole body). Therefore, the pressu the corresponding line for the pulmonary artery would not spike as high on the g

3.2.5 – Initiation and Coordination of th

1. i) All the cardiac muscle for each pair of chambers needs to contract almost forceful contraction occurs, the volume of the chambers is sharply reduce is created.

   ii) There is a delay between contractions, so tha d is removed from the pumped to the lungs and body. Thi in re s the efficiency of blood pum

2.



3. **Myogenic:** word used to describe a muscle which is stimulated to contract fro of by nerve impulses from outside.

   Cardiac cycle: the pattern of electrical excitatio ac ons and relaxation

4.

None (Norm	Resting heart rate of 101 bpm; in levels with exercise. Smo
Bradycardia	Patient is suffering from shortne chest pains, and is likel
Ectopic heartbeat	Resting heart rate of 48 bpm; ta suffering from side effects i
Fibrillation	Resting heart rate of 55 bpm; pa in for a routi
Tachycar	Resting heart rate of 62 bpm; p Electrocardiogram show

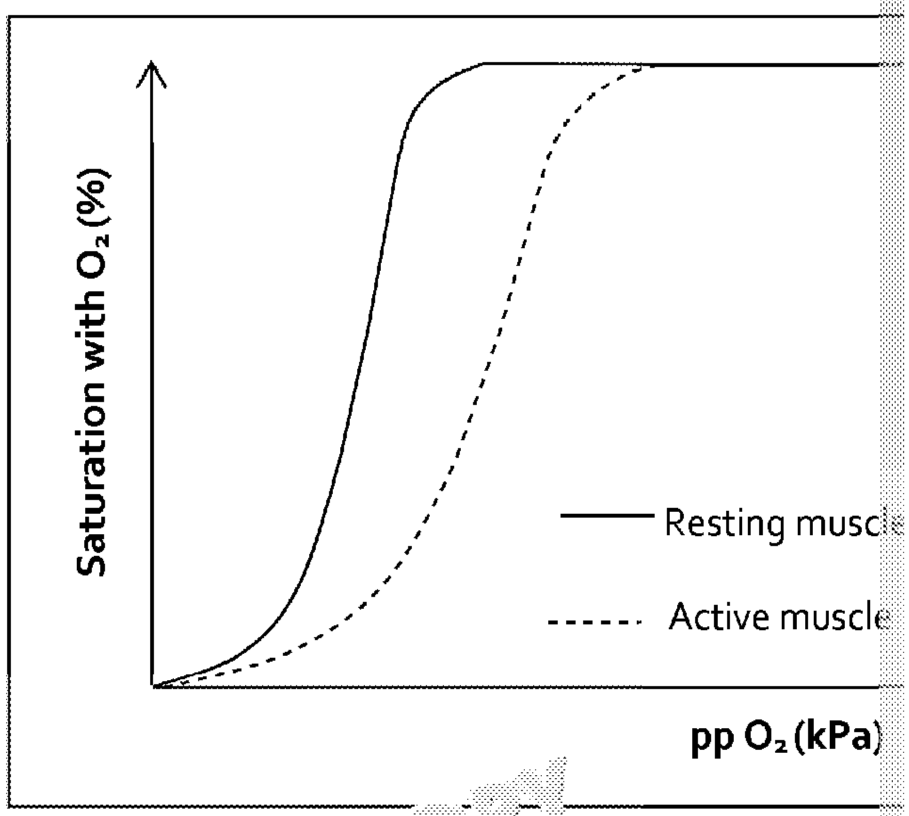
5. An artifi pacemaker mimics the sinoatrial node, which creates waves of exc connected to the heart through wires, and creates regular electric impulses wh cardiac muscle.

3.2.6 – Haemoglobin

1. respiratory, four, lung, dissociates, Bohr effect, hydrogencarbonate ions, carbo
acid, buffer

2. In active muscle tissue, respiration creates CO_2 – this has the effect of decreasin
(the Bohr effect) and pushing the dissociation curve to the right.

   Resting muscle has a low concentration of CO_2, and here haemoglobin's affinity
'delivered' to the tissues.



3. If the dissociation curves were the same, it would mean that the mother's hae
would have the same affinity for oxygen at the same concentration.

   Under these conditions, when the mother's haemoglobin reached the baby and
oxygen, as it would not bind to fetal haemoglobin either. Similarly, when fe
accept oxygen, the mother's haemoglobin would not release it.

4. If the chloride shift did not occur, the blood plasma would become more negati
within the red blood cells would become more positive.

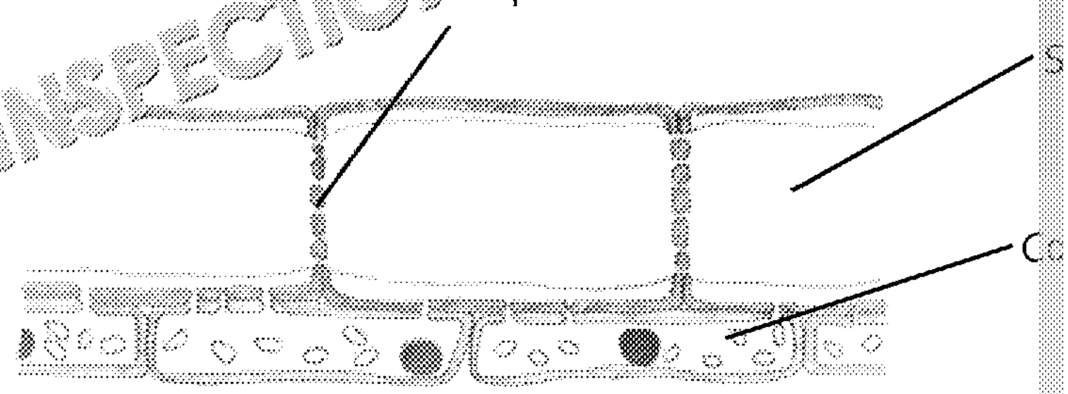
5. $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$

6. Myoglobin has a high affinity for oxygen, and only releases it when the surround
low. This suggests that it may be used as an emergency store of oxygen, provid
supply of the gas for muscles. This is useful for muscles which are carrying out i
respiring quickly.

3.3.1 – Looking at Vascular Tis

1. Cohesion and surface tension. Hydrogen bonding between water molecules ca other, and to the sides of narrow xylem vessels, creating an effect known as cap be drawn up the vessel easily, in a process which does not require ATP.

2.



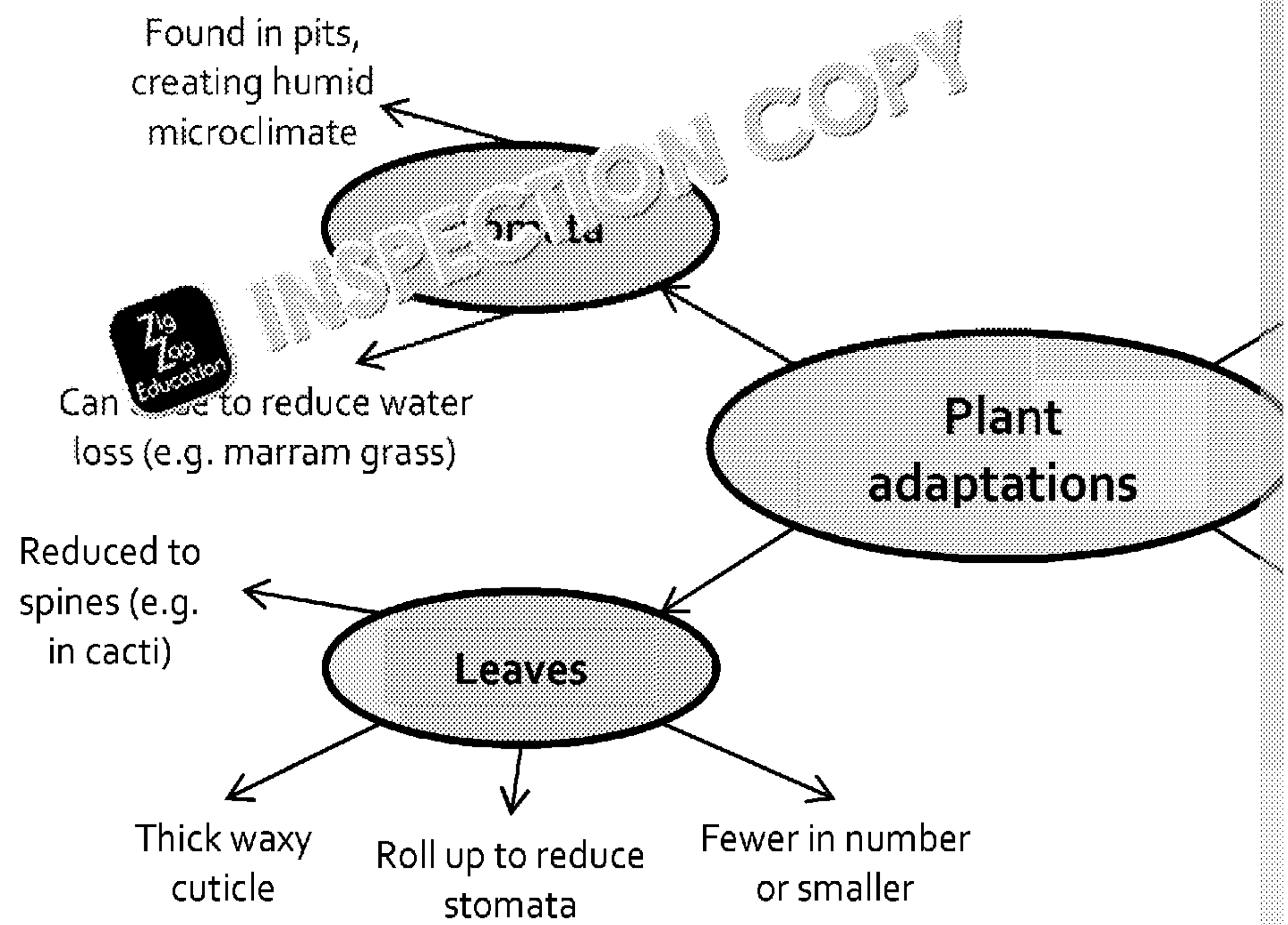
3.

	Xylem	
Structure	Rows of dead cells with no cytoplasm or organelles, with walls thickened with lignin to prevent collapse	Si sieve n
End cell walls	None	P
Active or passive transport?	Passive (transp[illegible]n pull)	
Substances transported	[illegible]at[illegible] mineral ions	

3.3.2 – Transpiration

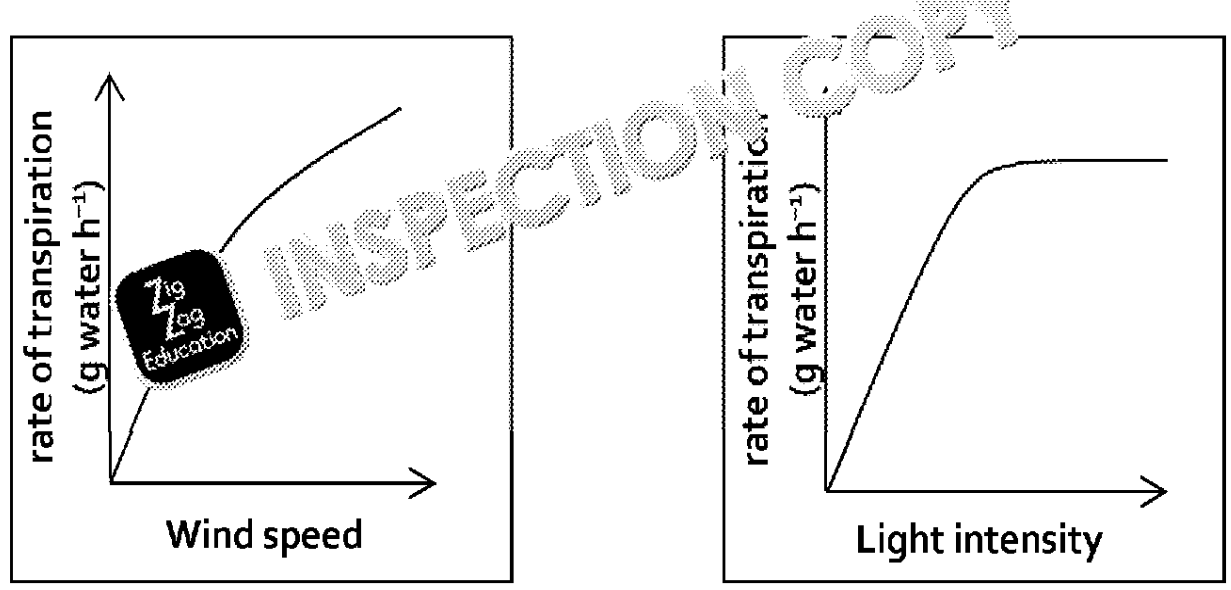
1. During the day, the plants are actively carrying out photosynthesis as well as re
gases in order to replenish carbon dioxide quickly, since its concentration in the

2.



3. Humidity is so high that the gaseous water vapour concentration outside the lea
There is no concentration gradient and so water vapour is as likely to enter the le

4.



5. The layer of oil prevents water evaporating from the surface of the beaker, sinc
surface of the water.

6.
- Replication allows you to check the consistency of measurements.
- It enables identification of anomalies.
- It tends to increase the accuracy of conclusions that you make as random e

7. Examples include:
- For photosynthesis, leaf surface area needs to be as large as possible; how
through transpiration. The waxy cuticle, a waterproof coating to the leaf, i
Plants may also fold their leaves in, reducing the surface area.
- Increasing the number of stomata increases the rate at which CO_2 is availa
increases water loss. Plants may deal with this by having stomata which a
... They may also close their stomata during the hottest, brigh
the day and open them at night as CAM plants do.
- The leaf area is usually thin to maximise gas exchange – again, this also in
deal with this by having thick, succulent leaves which retain water.

3.3.3 – Water Uptake and the Transpira

1. Cohesion – water molecules 'stick' together slightly because their negatively ch temporary hydrogen bonds with the positively charged hydrogen poles of other when water molecules move up through the xylem, they attract others below th

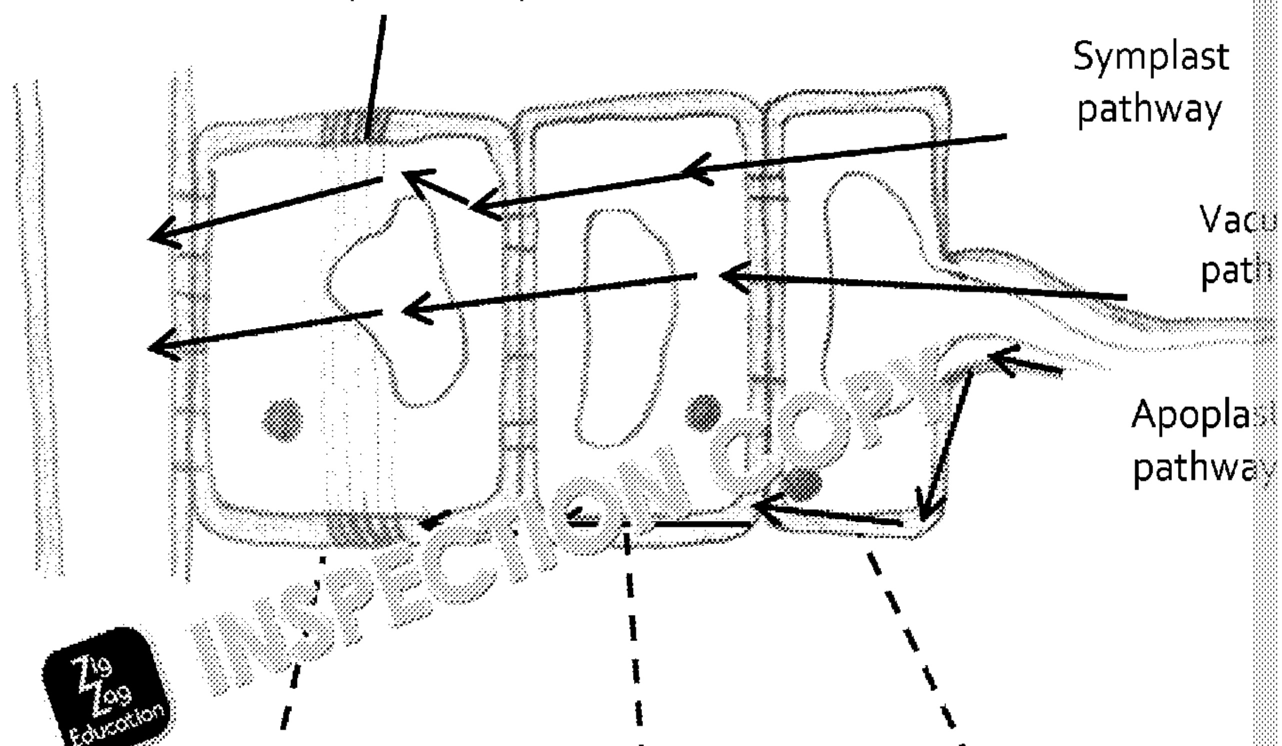
   Adhesion – water molecules adhere slightly to the cellulose walls of the xylem. column of water.

2. If the stream of water in the xylem is broken, the cohesion between water molec evaporating from the leaf will no longer cause water to be drawn up this part of this section of xylem will be starved of water and will die.

3.

Endodermis	Pathway which water ta between the cytoplasm a
Medulla	A band of waxy hydropho which controls water's rou
Apoplast	Pathway which water ta between the cell
Casparian strip	The centre of the root, wh othe
Vacuolar	The outer part of the roo once it is taken u
Cortex	
Symplast	

4.



3.3.4 – Water, Climate and Adapt

1.

	Xerophytes	
Stomata	Reduced number of stomata. Stomata may only open at night, or at certain times of day.	Stomat and are
Leaf [illegible]/[illegible]	Fewer leaves and reduced leaf size. In some plants, the leaves may be reduced to spines or needles.	Leaves i
Roots	Deep, penetrating taproots to absorb water deep in the soil, and/or an extensive network of shallow roots to quickly catch rainwater.	Root ti

2. Xerophytes typically have a thick waxy cuticle to prevent water leaving the plan repel water and stop it from covering the plant's upper surface (respiratory gase from water than from air).

3. transpiration, stomata, photosynthetic, Crassulacean, hydrophytes, aquatic, ph

4. i) This shields the stomata from the wind, meaning humid air does not blow a 'pocket' created by the leaf. This lowers the water potential gradient aroun rate at which water evaporates.

   ii) For terrestrial plants, most or all stomata are found on the lower surfaces o upper surface would have no eff[illegible] [illegible] might actually increase losses fro

5. For plants living on th[illegible]:

   - Sa[illegible] [illegible] retain water well, and so rainwater percolates through the g by[illegible]nt.
   - High levels of salt (salinity) from the ocean mean that the plant has issues a the soil tends to pull water out of the roots by osmosis, and the plant has t cope with this.

3.3.5 – Transpiration

1. sources, sinks, active, sugar/sucrose, water potential, down, osmosis, pressure,

2.
   - Sieve tube cells have thin cytoplasm and few organelles to limit restrictions
   - Perforated sieve tube plates are found at the end of each cell, to allow faste
   - Companion cells have many mitochondria so that they can actively load su diffuses into the main sieve tube.
   - The companion cells are [illegible] the sieve tube by thin gaps called plasmo movement of substances such as sucrose into the sieve tube.

3. Translocation rate would likely increase if the temperature rose from 20 °C to 30 reaction [illegible] as respiration would happen faster (providing more energy for ac

   Translocation rate would almost certainly decrease if the temperature rose from well outside the normal range of temperatures for most plants, and key enzyme

   A respiratory inhibitor could plausibly stop transpiration, and in large enough qu starving key tissues of oxygen.

4. Changing the temperature would have no effect on xylem flow, because the xyl tissue and does not respire or use active transport. A respiratory inhibitor would water through the xylem, although if the respiratory inhibitor is soluble, it could the transpiration stream.

5. In the trunk of a tree, the outer layer (cortex) contains the bark, as well as the ou The outer vascular tissue contains the phloem vessels.

   Removing a full ring of phloem tissue would cause [illegible] mass flow within ea cannot be sustained without a connection between sources and sinks. Instead, t where the sieve tube meets the air [illegible] would force phloem sap to 'bleed' ou

   Tissues that do not photosynthesise and produce their own sugars, such as the They would not [illegible] to carry out respiration, and the plant would die.