Qualification Accredited

OCR
Oxford Cambridge and RSA

AS and A LEVEL

Exemplar Candidate Work

BIOLOGY A & B (ADVANCING BIOLOGY)

H020/H420 and H022/H422

For first teaching in 2015

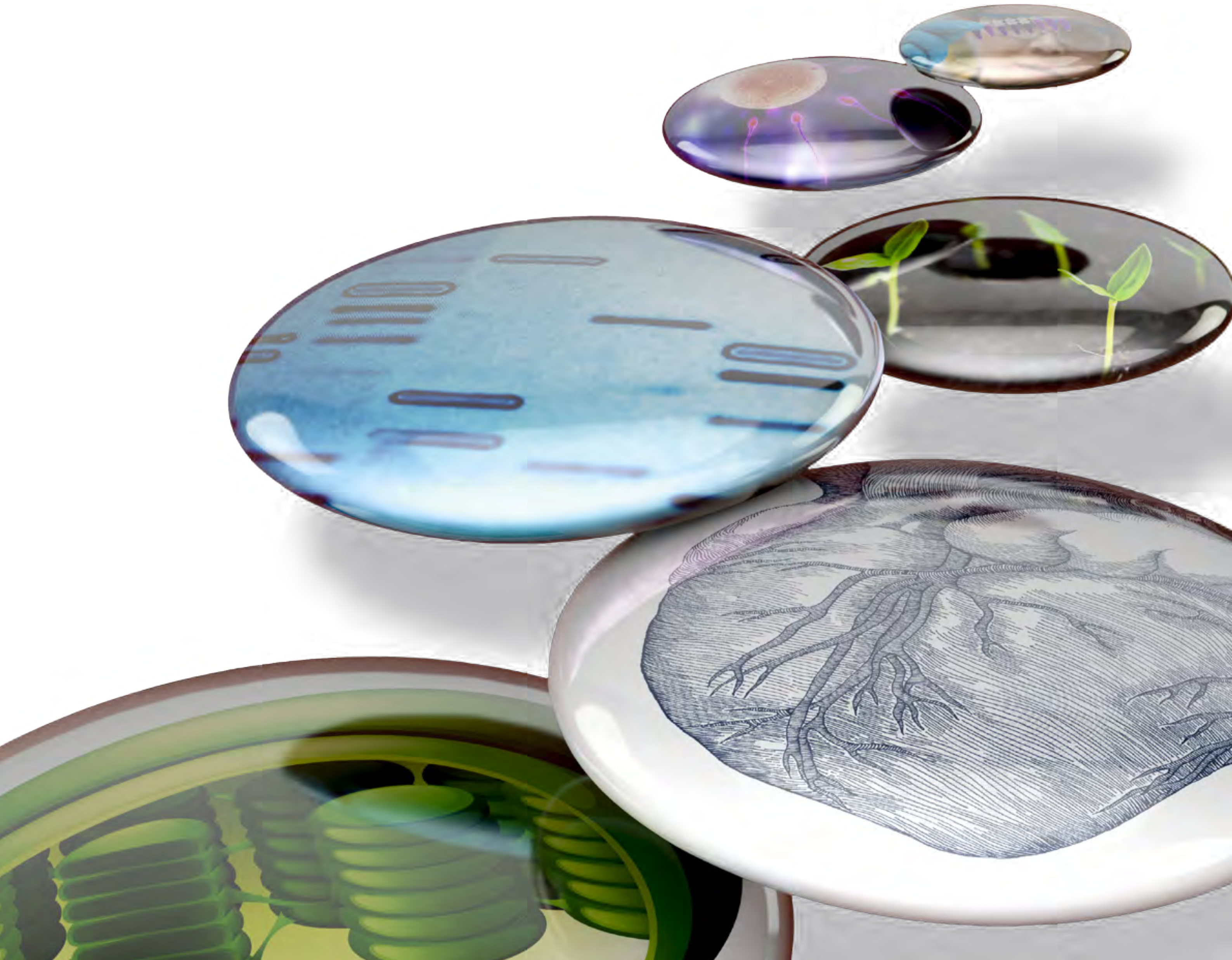
Appendix:
OCR GCE Biology A and Biology B (Advancing Biology) – Exemplar Learner Responses to Level of Response Questions – 2015 Specifications H020 and H022

Version 1

www.ocr.org.uk/biology

Contents

H022/02 Sample question paper – Question 1 responses



1

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

H+ ions actively transported out of companion cells to surrounding tissue cells, then via co-transportation sucrose and H+ ions diffuse back into the companion cells across the cell membrane and cell wall. This increases the concentration of sucrose inside comp cell which causes concentration gradient which leads to the diffusion of sucrose into the sieve cells this lowers the water potential causing water from surrounding and nearby cells to move into the phloem by osmosis this movement causes a hydrostatic pressure gradient causing the solution to move from the region of high hydrostatic pressure to a region of low hydrostatic pressure toward the sink cells of the phloem*. This process may be known as ~~mass~~ translocation

* by mass flow.

[6]

2

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

• Mass flow
loading of sugar increases the hydrostatic pressure, unloading of sugar decreases the hydrostatic pressure.
Sugar and other assimilates move from an area of high hydrostatic pressure to an area of low hydrostatic pressure therefore sugar is transported to different parts of the plant. [6]

• sugar loaded into sieve tubes ↓ lowers the water potential, water moves into sieve tube, increase in hydrostatic pressure.

• sink, → sugar moves out of sieve tubes, water potential increases higher than surrounding cells water moves out lowering hydrostatic pressure.

3

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The mass flow hypothesis. ~~Sucros~~ Sugars ~~...~~ eg. sucrose are loaded at the source: companion cells use ATP energy to actively transport H^+ ions into the surrounding tissue. Hence a diffusion gradient is set up so H^+ ions diffuse back into companion cells (down diffusion gradient) through cotransporter proteins which enable the H^+ ions to bring sucrose molecules into the companion cells with them. ~~the~~ Concentration of sucrose builds up in companion cells causing sucrose to diffuse ~~sucrose diffuses~~ in to seive tube elements through plasmodesmata (down concentration gradient) → Ψ decreases in S.T. element so water moves in by osmosis, increasing hydrostatic pressure at the source; water ~~...~~ moves from higher to lower hydrostatic pressure, carrying sucrose with it, along seive tube elements to the sink. [6]

4

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The mechanism is called translocation it transports sugars ~~fassition~~ by mass flow, for the loading of sugars this involves companion cells and the sieve tube elements. Hydrogen ions are moved out of the companion cells due to ~~ATP~~ the ~~feedn~~ mitochondria producing ATP this ~~produces~~ creates a H+ ion ~~g~~ concentration gradient bringing back with it a sucrose molecule into the companion cell then ~~back~~ through the plasmodesmata reaching the sieve tube ~~el~~ element. For the transport this is due to high hydrostatic pressure from the source as water moves into the cells where the sucrose is, to balance out the water potential by osmosis. This causes a flow down the pressure gradient high to low throught the sieve plates which are perforated, to the sink. ~~though any the thy~~ [6]

5

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Translocation is the movement of assimilates throughout a plant through phloem. The companion cells have large numbers of mitochondrion, the production of ATP pumps H^+ ions out of cytoplasm to surrounding tissue. Diffusing back in, return in with sucrose by use of co-transporter proteins. Once the companion cell has a higher concentration of sucrose than the ~~ph~~ sieve tube, there is a lower water potential so they move through plasmodesmata by diffusion. This increases sucrose levels, ↓ water potential in sieve tube, therefore water enters by osmosis creating an ↑ hydrostatic pressure, causing movement. **[6]**

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6

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

One possible mechanism is translocation. This is the movement of assimilates (sugar) to where they are needed in the plant. phloem consists of two elements, the Sieve tube and the companion cells. In the companion cell H^+ ions ~~as~~ move into the mesophyll cells by active transport causing the concentration of sucrose to increase. ~~and~~ sucrose moves into the sieve tube by diffusion or active transport. Water then moves via osmosis from adjacent cells into the sieve tube, increasing the hydrostatic pressure (HP). This HP gradient causes the water and dissolved sucrose to move (by mass flow) to a part where the HP is less. At the sink the sucrose diffuses into a companion cell. **[6]**

Therefore the water potential is less in the sieve tube causing it to move into adjacent cells.

7

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

~~Hydrogen Ions~~ Translocation is the mechanism it moves sugars from the source to the sink. H+ ions leave the companion cells to the apoplast causing the sucrose concentration to increase. This causes sucrose to move ~~out of the~~ into the sieve tube by diffusion. Water moves into the sieve tube by osmosis. The hydrostatic pressure increases causing the sugar to move down the phloem.

[6]

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8

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The mechanism is ~~translo~~ translocation

companion cells actively transport

[6]

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9

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

the mechanism is translocation. companion cells actively transport proton into surrounding tissues, concentration gradient means H/+ ions back into companion cells carrying glucose through carrier proteins, the glucose then moves by diffusion through plasmodesmata into sieve tube element. H_2O follows by osmosis, creating hydrostatic pressure which forces sap along phloem.

[6]

10

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The mechanism is translocation. Companion cells actively transport protons into surrounding tissues. ~~a~~ Concentration gradient means H^+ ions diffuse back into companion cells carrying glucose through carrier proteins. The glucose then moves by diffusion through plasmodesmata into sieve-tube elements. Water follows by osmosis, creating hydrostatic pressure ~~wh~~ which ~~fo~~ forces sap along phloem.

[6]

11

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

o H^+ ions pumped out of companion cells by active transport into surrounding solution (ATP used in process)

o H^+ ions then bind to sucrose molecules which are then reabsorbed into the companion cell by cotransporter proteins (diffusion)

o sucrose then diffuses into sieve tube element across numerous plasmodesmata *

Transport occurs by translocation where assimilates are moved from throughout the plant in the phloem tissue

* Sucrose loading into phloem at source causes water ~~potential~~ potential in sieve tube element to move in via osmosis thus producing a pressure that acts as a driving force **[6]**

12

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

translocation = hydrogen ions diffuse out of the companion cell and then back in again because of the concentration gradient while carrying sugars back with them. These sugars are then actively loaded into the sieve tube element using A.T.P. created in the companion cell's mitochondria. The increase in sugar concentration in the sieve tubes lowers the water potential within the cell causing water to enter it via osmosis. With ~~this~~ build up of water and sugar at the top of the phloem a pressure gradient going downwards is formed forcing the water (and sugar) downwards. The sugar diffuses into the sink where it is processed/used while the water exits via osmosis to maintain the pressure gradient [6]

13

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The companion cell of the phloem actively transport H+ ions out into the surrounding tissues. When the H+ ions return to the companion cell, cotransporter proteins allow them to bring sucrose with them. The sucrose concentration in the companion cell builds up, then moves by diffusion into the sieve cell.

[6]

14

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The companion cells actively transport H^+ ions into the surroundings. This creates a concentration gradient of H^+ ions. The H^+ ions ~~diffuse~~ move back into the companion cells by facilitated diffusion and with them they bring sucrose (sugar) molecules. This creates a concentration gradient of sucrose molecules (from the companion cells to the sieve tube elements). Sucrose moves by ~~the~~ facilitated diffusion into the ~~sie~~ sieve tube elements. **[6]**

15

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Sugars in the form of sucrose are transported in the phloem by translocation. Sucrose is transported into the phloem by active transport. While the companion cells using ATP actively transports hydrogen ions out of the cytoplasm and into the surrounding area. This creates a diffusion gradient that allows H ions back in, using cotransporter proteins with sucrose bringing it into the companion cell. The sucrose then diffuses into the the phloem through the plasmodesmata **[6]**

(16)

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

The ~~protein~~ companion cell actively transports H+ ions out of the cell, they diffuse back down the concentration gradient carrying sucrose molecules with the help of cotransporter proteins. The companion cell ~~thors~~, has pores called plasmodesmata and the ~~H~~ sucrose diffuses from the companion cells to the sieve tube elements down the concentration gradient **[6]**

17

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Companion cells (next to the tubular sieve elements) actively transport H^+ ions out of the cell, so they they can diffuse back into the companion cell by osmosis, carrying sugars with them (in solution). The sugars (sucrose etc.) can then diffuse through plasmodesmata into the sieve tube element.

Once in the phloem, sugars can be transported by mass flow. The high sugar concentration near the source means water moves into the phloem by osmosis, raising the hydrostatic pressure. This creates a ~~concentration~~ pressure gradient, so the dissolved sugars move along the phloem towards lower hydrostatic pressure at the sink, where sugars can diffuse out of the phloem followed by water (by osmosis), ~~maiting~~ maintaining the lower hydrostatic pressure to ensure the pressure gradient is kept.

[6]

(18)

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Sugar is actively loaded into the phloem
lowering the water potent, water then moves in by osmosis
from the / This increases the pressure
at this end of the phloem

At the sink, ~~Phloem~~ sugar is removed
from the phloem and used. This increases the
water potential in the phloem, causing water to
move out of the phloem by osmosis.
This decreases the pressure at this end of
the phloem. Sugar moves down the pressure
gradient, causing the transport of
sugar in the phloem **[6]**

19

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Sugars are loaded by active transport and osmosis. A concentration gradient is created to help aid loading and transportation. Sugars can move up and down the ~~pt~~ phloem. ~~By the~~ Movement by the process of active transport, ~~ATP is needed.~~ requires ATP.

[6]

20

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

At the top/areal parts of the plant during photosynthesis sucrose is made. ~~H+ mesoph~~ Companion cells actively pump (in the process of active transport) H+ ions into mesophyll cells where it gains a sucrose molecule and diffuses back into the companion cells by simple diffusion because of the concentration gradient. Sucrose diffuses by simple diffusion into the phloem because there is a ~~ste~~ concentration gradient. ~~called~~ ~~this~~ This process is called active loading. As sucrose enters the phloem Ψ decreases so water also enters this increases hydrostatic pressure forcing the sucrose down the phloem. At the lower parts of the plant there is a low sucrose concentration so it leaves by simple diffusion. Ψ ~~pote~~ in phloem then decreases so water also leaves.

[6]

21

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Active transport is a following mechanism. Sugars leave the phloem & then hydrogen ions leave the companion cells. Sugars attach to hydrogen ions and move into the companion cells through active transport & then can move into the phloem through sieve cells. The phloem will then allow the transport of sugars due to the energy they still contain from the active transport

[6]

22

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Active transport loads sucrose into the phloem. It is then moved down the diffusion gradient which is set up by the movement of hydrogen ions due to ATP once in the phloem water potential is decreased and hydrostatic pressure is increased. Water moves down the sieve tube from high hydrostatic pressure to low hydrostatic pressure. Sugar molecules then use active transport to move to surrounding cells reducing hydrostatic pressure so mechanism continues

[6]

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23

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Active transport. The companion cell ~~active~~ actively pumps H^+ ions into the surrounding enviroment / assimilates which creates a H^+ ion concentration gradient. Assimilates move in with H^+ ions and diffuse through plasmodesmata from companion cell into sieve tube element. ~~Ψ~~ water ~~potential~~ potential is reduced and water moves by osmosis increasing hydrostatic pressure in the sieve ~~tube~~ tube element. Water moves from an area of high hydrostatic pressure to an area of low hydrostatic pressure down a pressure gradient transporting the sugars in the ~~phloem~~ phloem **[6]**

24

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

~~One example is root pressure, which is caused by the active transport of mineral ions into the root. This raises a large xylem from the~~

Firstly, H^+ ions are moved outside the phloem the companion cells by active transport. These bond with glucose and other sugars outside the phloem. ~~and~~ The H^+ ions then diffuse back into the companion cell, carrying the sugar with it. The sugars then diffuse into the sieve tube through the plasmodesmata. This lowers the water potential in the sieve tube. Water moves down the water potential gradient by osmosis. This causes mass flow in the direction where sugar is deficient.

[6]

25

5

(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Translocation - the companion cells next to the phloem sieve elements are very metabolically active, with lots of mitochondria. The companion cells pump out ions, which then bind to sugars outside the cell (pumped out against conc. gradient so active transport) and then using cotransporter proteins, transport the sugars ~~back~~ in along the conc. gradient of the ions. ~~Then~~ The sugars in the companion cell then diffuse through the plasmodesmata into the sieve tube elements, along the conc. gradient, where they create a source. The sugars then move to the sink through the phloem because of high hydrostatic pressure in the source end low hydrostatic pressure in the sink.

[6]

26

5

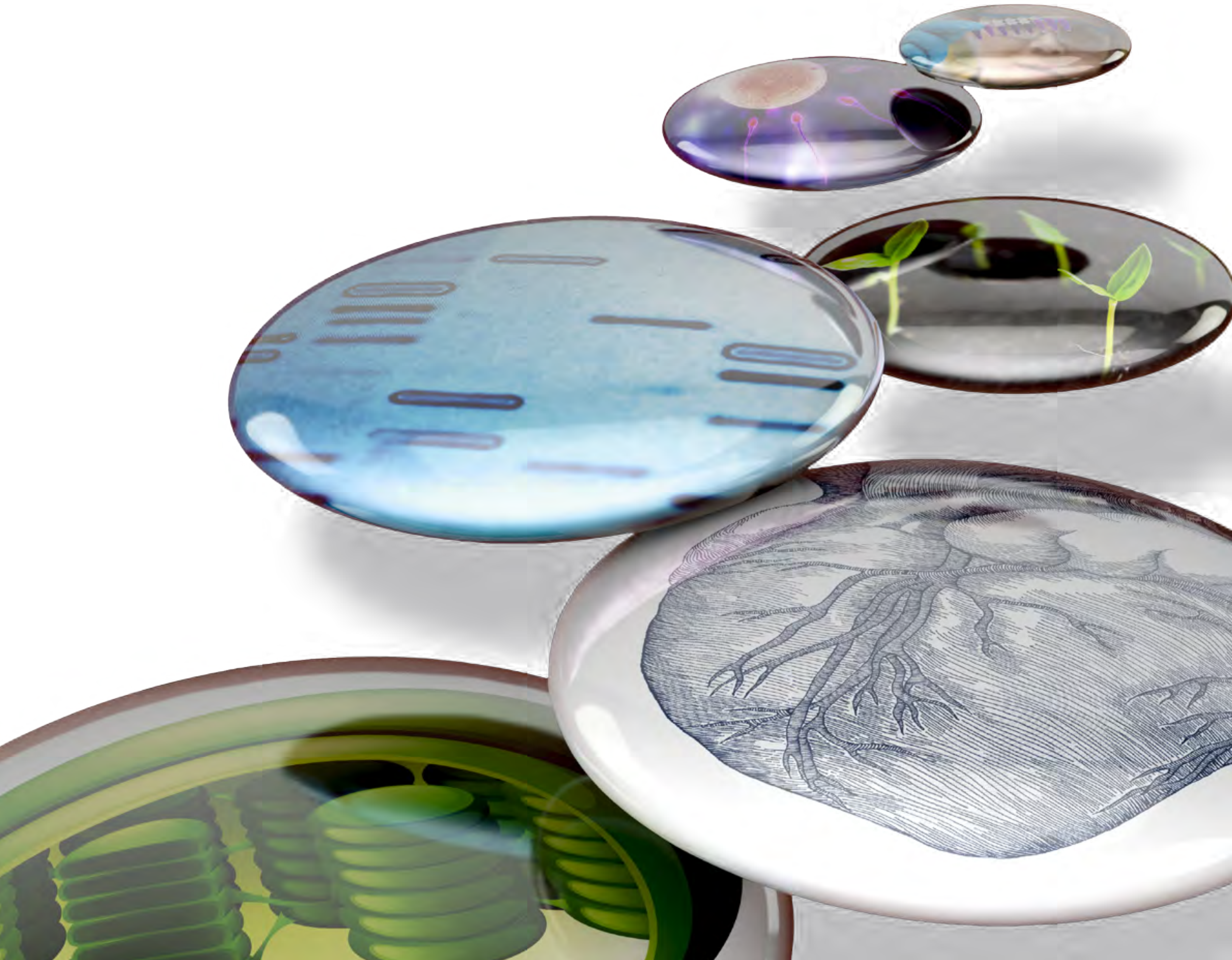
(c)* Explain a possible mechanism for the loading and transport of sugars in the phloem.

Each seive tube element has a companion cell that can pass molecules or ions across a plasmodesmata, a gap in the cell wall between the cells. The companion cell moves H^+ ions into the seive tube, by active transport This causes sugars to diffuse into the companion cell ~~as~~ ~~the~~ following a diffusion ~~gradient~~ ~~in~~ ~~to~~ gradient. The H^+ ions ~~the~~ then ~~ca~~ return to the companion cell, so the diffusion gradient ~~g~~ causes the sugar to enter the seive tube.

[6]

 H022/02 Turn over

H020/02 Sample question paper – Question 2 responses



1

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

They live in places with lower kPa of oxygen and so need a high affinity for O_2 in order to get enough O_2 to respiring tissues. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

The different amino acid on the ~~B~~ B chains of each molecule means the primary structure is different. ~~Therefore the seco~~ However the secondary, tertiary and quaternary structures are most likely the same as there is very little alteration to primary structure.

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. ~~Ha~~ Insoluble
2. Structural
3. Fibrous

[3]

 H020/02 Turn over

2

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

This means the llama haemoglobin has a higher affinity ~~for~~ for oxygen and hence it becomes more saturated ~~at~~ than the camel haemoglobin at the same oxygen concentration, so more oxygen is carried in the blood → better survival rate. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

o Different primary structure (order and sequence of amino acids in the polypeptide chains)
o Different secondary structure (folding mechanism) as different amino acids cause a different overall charge
o Different overall 3 dimensional shape (tertiary structure)
o This can affect the quaternary structure
↳ Different amino acid constituent may lead to a change in the number of hydrophyllic/phobic R group interactions, disulphide bridges, ions and hydrogen bonds thus shape is altered.
o Different number of peptide bonds between molecules

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. Insoluble fibrous proteins compared to soluble globular proteins.
2. Fibrous proteins are much stronger than globular proteins
3. ~~Gl~~ Globular proteins can have an active site and hence act as enzymes

[3]

3

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

Because at high altitudes where it lives, there is less oxygen so oxygen dissociation in a llama has to be higher for them to survive. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

For each haem prosthetic group of haemoglobin (Fe^{2+}) one oxygen molecule can attach, so llama haemoglobin may have more haem/ prosthetic groups. As there is one prosthetic/ haem group per alpha or beta chain in haemoglobin, llama haemoglobin may contain more chains. For easier diffusion, the quaternary structure of llama haemoglobin may have a thinner biconcave shape.

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. It is long and thin and not rounded
2. It doesn't have to have quaternary structure
3. It does not have all hydrophobic parts facing inwards. [3]

1]

4

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

so it can take ~~it~~ oxygen at a lower pO_2 as it lives ~~at~~ in an area

[2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

Llama Hb would have a higher affinity for oxygen so it picks up oxygen more easily

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. no hydrophobic – hydrophilic interactions
2. fibrous proteins are soluable in water
3. globular proteins have a prosthetic group.

[3]

5

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

llama haemoglobin ~~they~~ need to be able to associate with O_2 at lower partial pressure as they live at higher ~~altitudes~~ altitudes, where the partial pressure of O_2 is lower. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

different tertiary structure means haem groups can bind to O_2 more easily.
∴ different secondary structure (the coiling/pleating of the polypeptides)
~~and ff~~ This is caused by differences in the primary structure (the number & sequence of amino acids)

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. insoluble
2. high tensile strength (good for structural roles)
3. [redacted] different tertiary structure
↳ more linear
[3]

6

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

The llama lives in a low oxygen environment so requires a higher affinity to oxygen in its haemoglobin than an animal in higher oxygen conditions e.g. the camel [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

llama haemoglobin must have a different order of amino acids in its primary structure, resulting in a different shape in the secondary structure as a different number of α-helix and β-pleated sheets form. This leads to a different 3D globular shape in the tertiary structure, as the hamoglobin forms different hydrogen, ionic and disulfide bond and has different ~~hydrophobin~~ hydrophobic interactions. This results in the 4 polypeptide chains in the ~~tertiary~~ quaternary structure to bond differently. This results in the llama haemoglobin having a higher affinity for oxygen [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. insoluble
2. forms fibrin
3. dense

[3]

7

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

llamas live in a higher altitude environment & so require haemoglobin that binds to oxygen at a lower partial pressure and unloads oxygen less rapidly [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

llama haemoglobin has a higher affinity for oxygen this means the overall ~~tertiary~~ quaternary structure is different to camel haemoglobin. This is due to the ~~different~~ slight different sequence of amino acids that make up the specific polypeptide chains this polypeptide chain affects the secondary structure of the polypeptide chains affecting the beta pleating and alpha coiling this forms a different tertiary structure of each polypeptide chain allowing a better fit for O_2 molecules to bind to the haem group causing and overall different quaternary structure due to the [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. long straight chains of amino acids
2. ~~amino acids bonded in the same orientation~~ more tensile strength
3. insoluble

[3]

8

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

- llamas live at high altitudes with lower partial pressures of oxygen so need to bind oxygen (with ~~more~~ higher affinity) better [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

Primary, secondary, tertiary structure of α subunits is the same.
The primary structure is different for the β subunits due to different amino acid/sequence. This means the secondary structure differs; differently hydrogen bonded α helix & β-~~shee~~ pleated sheets form. The tertiary structure will likewise be different (di-sulfide bridges etc.)* Only 1 amino acid is replaces so the structure should be similar. * The shape is different
The quaternary structure will be different as the α and β units will interact differently. This means the level of binding to oxygen will differ [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. Not soluble / nonpolar
2. Rigid / high tensile strength
3. larger

[3]

9

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

oxygen needs to be able to be loaded at low partial pressures, (higher affinity for oxygen ~~[illegible]~~. The llama won't get enough oxygen, oxygen would dissociate if still had camel haemoglobin. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

- primary structure: unique chain of amino acids, peptide bonds, different amino acid for camel haemoglobin providing higher affinity
- Secondary ~~[illegible]~~ Structure: hydrogen bonds, α helix, chains coiled up.
- Tertiary Structure: folded further, hydrogen bonds, ionic bonds, hydrophobic + hydrophilic interactions, di sulfide bonds, different levels of bonds forming different folded structure.
- Quaternary: 4 polypeptide chains, 2 α chains 2 β chains, prosthetic group in each chain, Fe^{2+} (haem group) [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. ~~[illegible]~~ insoluble.
2. ~~[illegible]~~
3. ~~[illegible]~~ long cylindrical shape. [3]

tough.

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10

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

Llamas live at high altitudes where partial pressure of oxygen is lower than in the desert where camels live ∴ llamas haemoglobin needs to be able to pick up oxygen from lower partial pressures of oxygen than a camel's does. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

The primary structure of the llama will be different since there will be a different number and order of amino acids in the polypeptide chains. This could give rise to a different secondary structure, e.g. with different number of alpha-helices or β-pleated sheets ~~Abe~~ (or these could be at different positions in the chain). Though the overall (tertiary structure) 3D shape of llama haemoglobin will still be globular, it will be a slightly different shape to ~~camel~~ haemoglobin because the different 1° and 2° structures will cause hydrogen, ionic + disulfide bonds to form ~~at~~ different points* giving rise to a different overall shape. Llama haemoglobin may have more than 4 polypeptide subunits per molecule, enabling each haemoglobin molecule to bind to >4 O_2 molecules. [6]

* (there may also be a different number of each of these types of bond)

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. Not water-soluble
2. Strong (used for mechanical strength e.g. collagen)
3. Regular, repetitive sequences of amino acids

[3]

 H020/02 Turn over

11

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

As it requires a higher affinity for oxygen hence it is able to load oxygen at a lower partial pressure aiding its survival. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

For the primary structure, sequence in amino acids will be different resulting in a different polypeptide ~~chain~~ and sequence, also the there is one different amino acid. The secondary structure will the invariably be different with a different coiling of the primary structure forming a different secondary structure, hence a change in alpha helix and beta pleated sheet structure, held together by hydrogen bonds which may vary in number. The further folding will form the tertiary structure held together by H-bonds, ionic bonds, disulphide bonds and hydrophobic / hydrophilic bond due to the R group on the amino acids. However the quaternary structure is the same 2 alpha and beta subunits forming a haemoglobin protein. [6]

SPECIMEN

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. Insoluble
2. Strong
3. Unreactive

[3]

 H020/02 Turn over

12

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

The llama need a higher affinity for oxygen as they live at high altitudes which have a ~~hig~~ low partial pressure of oxygen

[2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

Llama haemoglobin would have a different primary structure, sequence of amino acids. The bonds forming the tertiary structure are weaker and can deform more to allow oxygen to enter.

[6]

(c) Collagen is a fibrous protein.

State three **properties** of a fibrous protein that are different from those of a globular protein.

fibrous proteins

1. Long and thin and not rounded

2. fibrous proteins do not have a quaternary structure

3. fibrous proteins ~~do not have~~ usually form structures

[3]

 H020/02 Turn over

13

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

.Can higher affinity for oxygen ; can pick up O_2 in a lower pO_2 ; less O_2 where they live.

[2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

The different amino acid in the β chain of each molecule means the primary structure is different. However the secondary tertiary and quarternary structures are most likely the same as there is very little alteration to primary structure.

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. Insoluble
2. Structural
3. Fibrous

[3]

14

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

It must be to the left to allow association and dissociation of O_2 ~~at~~ in higher altitudes where O_2 concentration is lower. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

- Haemoglobin has 2 alpha and 2 beta polypeptides
- If in camels one amino acid is different in each beta polypeptide then the primary structure (sequence of amino acids) will show a different order.
- Therefore the two primary structures will coil and fold into two different secondary structures because the hydrogen bonds will be present in different places and the R groups on amino acid different so hydrophobic and hydrophillic bonds in diff. places.
- Therefore the further folding to form the tertiary structure will form two different structures. [6]

(c) Collagen is a fibrous protein. collagen haemoglobin
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. fibrous are ~~3 polypeptide chains~~ insoluble in water
2. fibrous have helical structure
3. fibrous have stronger intermolecular forces [3]

* Quaternary structure will both be different as each of the 2 beta polypeptides will have folded different.

↳ so different hydrogen bonding between the polypeptides as well.

15

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

Haemoglobin of the llama needs to be at a higher affinity so more oxygen can be picked ~~up~~ at a lower pressure. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

Both llama and camel have difference in the primary structure. As they have a difference in the amino acid sequence. This leads on to a change in the secondary structure as it's the primary structure which is coiled to form it. There are different Hydrogen bonds present. so a different shape. All this also leads to a difference to the tertiary structure. This bring an overall change to the 3D structure [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. insoluble
2. Strong
3. unreactive

[3]

 H020/02 Turn over

16

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

llamas live at high altitudes where the partial pressure of Oxygen is low whereas Camels live at low altitudes [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

The sequence of amino acids will differ between the two proteins (primary structure). In the β subunits the primary structure differs between camel and llama by one amino acid. The quaternary structure is identical. The tertiary structure must be similar as structure determines function of biological molecules. The secondary structure will not differ as the two proteins have the same number of α and β subunits

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. high tensile strength
2. insoluble
3. fibrous proteins don't take part in metabolic reactions [3]

17

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

They live at high altitudes where the partial pressure of oxygen is low. llamas have a higher percentage saturation for same pressure [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

both llama and camel haemoglobin have 4 subunits. An amino acid on one B-subunit is different on a llama to a camel. This will alter primary structure as different sequence of amino acids, secondary structure as it will coil in a different way, tertiary structure as the bonds will be different and quaternary structure so overall it will have a different 3-D shape.

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. have structural roles
2. usually insoluble
3. form fibres

[3]

	H020/02	Turn over

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

llama's live in mountains where there is limited oxygen. so llamas need a high affinity for oxygen to bind to ~~move~~ oxygen at the lungs ~~around the body to supply all cells~~. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

Both llama & camel haemoglobin will have a similar primary protein structure (sequence of amino acids) and a similar secondary structure. However the tertiary structure will ~~contain more haemoglobin haem groups (containing iron ions). this will cause it to have a greater affinity for oxygen~~ have a greater surface area in llamas so it increases rate of diffusion. ~~across~~ ~~the~~ llama haemoglobin may have less haem groups in its tertiary structure to lower O_2 concentration, so it is ~~easier for oxygen~~ maintains a steeper diffusion gradient. Quaternary structure made of 4 polypeptide chains. [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. ~~R~~ Cross-links (covalent bonds) ~~g~~ join collagen molecules
2. Tripple Helix ~~Tough~~
3. Strong

[3]

19

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

Because oxygen must dissociate more easily as llamas live at high altitudes where partial pressure of oxygen is lower. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

llama haemoglobin is likely to have weaker bonds ~~are~~ than camel haemoglobin. llama haemoglobin may be folded less and have a different 3D structure in it tertiary level.
In their secondary structure they are likely to have different regions of α helixes and β pleated sheets.

[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. long and thread-like
2. insoluble in water
3. strong hydrogen bonds hold peptide chains together. [3]

20

11

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

Llama haemoglobin must have a greater affinity for oxygen in order to pick it up at lower partial pressures, as O_2 is less abundant at high altitudes. This is shown on the graph as a shift to the left, as haemoglobin will pick up O_2 (become saturated) at a lower pO_2. [2]

(b)* Describe how the structure of llama hamoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

The primary (1°) structure is the order and number of amino acids in a polypeptide chain. The 2 α subunits of the camel and llama will have the same 1° structure, but the β subunits in the camel will differ to that of the llama by one amino acid.

In the secondary structure, the polypeptide chains will still have largely an α-helical shape, but the different amino acid with a different R (variable) group, which may have different properties, may cause the helix to fold up slightly differently, as the bonds cannot form in the same way.

Both llama and camel haemoglobin have a globular tertiary structure, so will be roughly spherical. However the 1 different amino acid may have an effect. If hydrophobic or hydrophilic it will change the hydrophobic interactions and the tertiary structure will alter slightly. If it contains sulfur it will allow disulfide bridges etc. So the tertiary structures will be similar but may have small differences.

The quaternary (4°) structure may also be different. The haem groups in llama haemoglobin may be more easily accessible for greater oxygen affinity for example, which would be required in a higher altitude environment with less abundant oxygen. [6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. Long, thin tertiary/quaternary structure
2. High strength/strong
3. Often have a structural function

[3]

21

(ii) Explain why it is important for the survival of the llama that the llama haemoglobin dissociation curve is to the left of the camel haemoglobin dissociation curve.

The llama haemoglobin must be able to associate with O_2 at a low partial pressure, like where it lives, so that enough O_2 can be delivered and CO_2 removed to support life & activity. [2]

(b)* sp. Describe how the structure of llama haemoglobin is likely to be different from that of camel haemoglobin with reference to the four levels of protein structure.

At 1° structure, llama haemoglobin is different because the order and sequence of amino acids is different in the β subunits. The change in 1° structure will mean that the 2° structure will change, including where and how many α helices and β pleated sheets will form. This would change the 3° structure and the types of bonds formed, such as hydrogen bonds, ionic bonds, hydrophobic / philic interactions and disulphide bridges. This would change the 4° structure also.

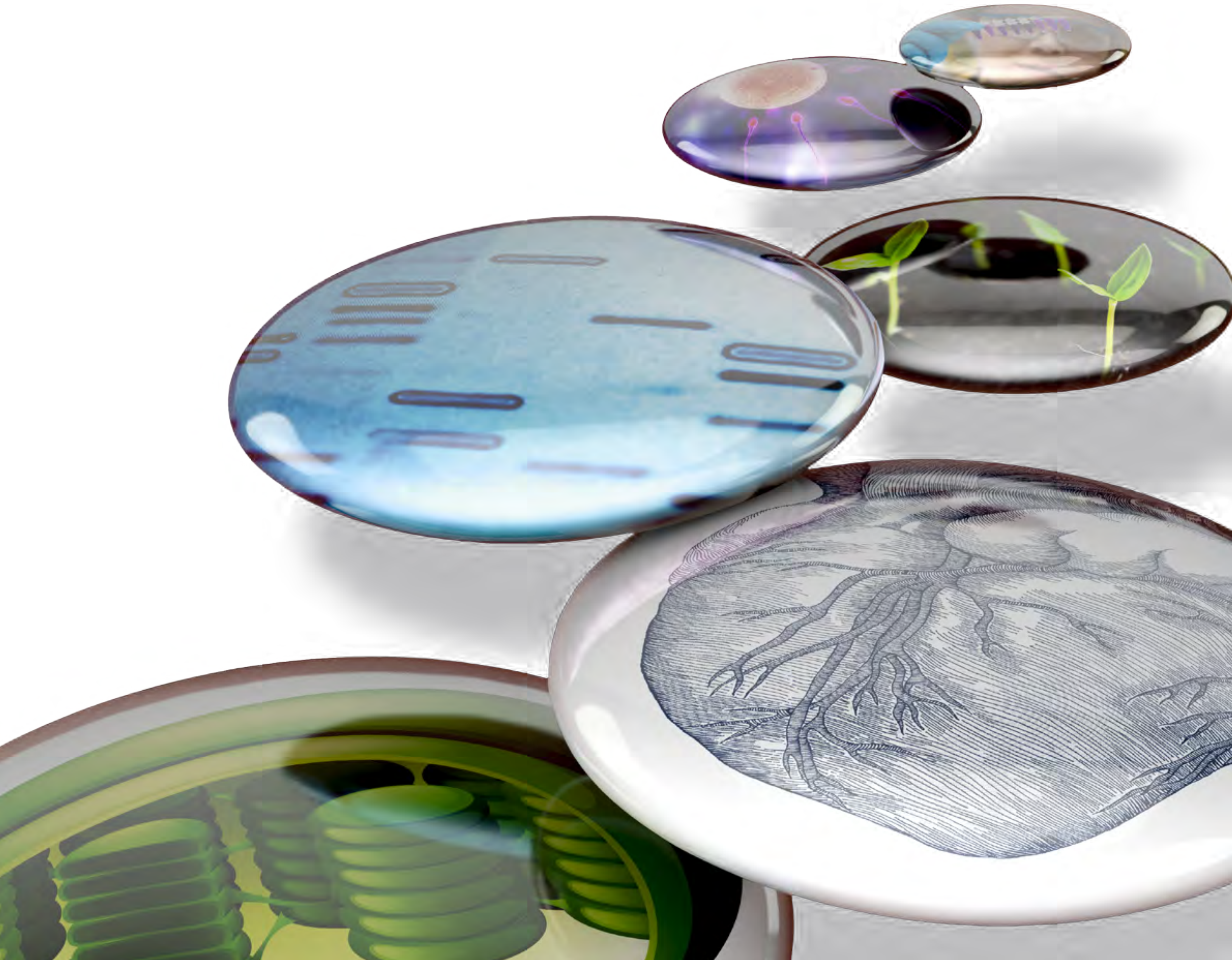
[6]

(c) Collagen is a fibrous protein.
State three **properties** of a fibrous protein that are different from those of a globular protein.

1. non soluble (fibrous)
2. globular has a rounded 3° structure, whereas fibrous is more thread-like
3. globular has more varied α helix / β pleated sheet 2° structure so that it folds up into a ball-like structure. [3]

 H020/02 Turn over

H020/02 Sample question paper – Question 3 responses



1

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
Common pipistrelle	5.5	0.22	52 – 60	medium to dark brown	woodland, hedgerows, grassland, farmland, suburban and urban
Soprano pipistrelle	5.5	0.21	42 – 47	medium to dark brown	wetland, woodland edge, tree lines, hedgerows, suburban gardens and parks

Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

Both are practically identical in terms of observational features ~~to~~ like their identical body mass of 5.5g and a wingspan of 0.22 and 0.21 meters, so it's not necessarily obvious and the two do not have distinct physical differences. However, their habitats are contrasting with the common pipistrelle found in farmland as opposed to soprano pipistrelle which are found in the tree lines. Moreover the range of their echolocation call is moderately different and can be a way of identifying them with the common having a maximum range of 60 kHz and the soprano having a max range of 47.

[6]

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2

14

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One could argue that the common and soprano pipistrelles are the ~~e~~ same species as they are very similar anatomically and look almost the same. They have the same mean body mass of 5.5g and almost identical mean wingspans differing by 0.1m between 0.22 → 0.21. They also appear the same medium to dark brown colour so to the naked eye there is no difference. On the other hand the pipistrelles differ in range of echolocation call with the aptly named soprano pipestrelle having a lower range of 42-47 kHz compared to the common pipestrelles range of 52-60 (a much larger range). Common pipestrelles also have a more diverse and further away from human activity habitat range making them more spread out. **[6]**

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3

14

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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The fact they are very similar anatomically supports the claim - same mass, wingspan and colour.
Also the same habitats supports the claim.
However non-overlapping ranges of echolocation suggests a distinct difference between the two groups of bat - suggesting they are different species.

[6]

4

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

Both animals are similar sizes, suggesting they could physically mate, which may hint they are the same species. the similarities in ~~size~~ mass ~~and~~ wingspan and colour should also suggest this. However the range of ecolation of the two animals does not overlap. ~~thi~~ This ~~tel~~ tells us they may hunt different animals and have significantly different organs for generating the sounds. This would suggest they are different. As well as this, although they both share some habitats (e.g hedgerows) they inhabit seperate ones, e.g the common pipistrelle ~~ev~~ lives in farmland, the soprano does not. This backs up the previous point. [6]

5

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The fact they are very similar anatomically supports the claim – same mass, wingspan and colour.

Also the same habitats supports the claim.

However non-overlapping ranges of echolocation suggests a distinct difference between the 2 groups of bat - suggesting they are different species.

[6]

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6

(b)* The pipistrelle is the most common species of bat in Europe.

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

Both pipistrelle have the same body mass and similar wigspans. They are similar in appearance ~~and~~ but live in fairly ~~similar~~ dissimilar environments. Their range of echolocation call varies and that is why they could be considered distinct species.

[6]

7

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'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

~~The~~ Both pipistrelles have different mean wingspans which support the ~~Sta~~ researcher's claims that they are distinct. The common pipistrelle has a mean wingspan of 0.22 m. ~~The soprano~~ Both have different echolocation callas. The common pipistrelle is 52 – 60 kHz and the soprano is 42 – 47 kHz This supports the researcher. Both ~~again~~ pipistrellas have a mean mass of 5.5 g and are both medium to dark brown.

[6]

8

(b)* The pipistrelle is the most common species of bat in Europe.

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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

In support of the claim, both types of pipistrelle have the exact same mean body mass of 5.5g and also a mean wingspan with a difference of only 0.01 m. The common pipistrelle has a span of 0.22 and the soprano has a span of 0.21. Another similarity to support the conclusion is that the both have a medium to dark brown colour. The both like in hedgrows and woodland areas, however there are some differences in habitat. The common pipistrell live in grassland, farmland and suburban & urban areas whereas the soprano lives in wetland, tree lines and only suburban gardens and parks. They also have a different echolocation call range with the sopranos being 42-47kHz unlike the common's 52-60 kHz range. **[6]**

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9

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The fact that the mean wing span is very similiar 0.22 and 0.21m is evidence that they are similiar species, also the mean body mass is exactly the same ~~but this could be~~ which suggests they are similar species however ~~[illegible]~~ both of these are affected by environmental conditions / factors, hence their adaptions are changed slightly but essentially ~~the~~ similiar species. However, the range of echolocation call is very different and they don't overlap, this could be due to genetic differences between the populations. Futhermore the colours are overall as well as the Habitats [illegible] hence could be similiar species.

need?

[6]

10

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The claim is supported by the fact that the ~~two~~ 2 populations have a different range of echolocation call : common pipistrelle 52 – 60 kHz and soprano pipistrelle 42 – 47 kHz which suggests they could hunt different insects/ prey ~~and~~ so be different species. Other than hedgegrows, the two also have different habitats which further supports the claim since members of the same species tend to live in similar or the same habitat. However the claim is challenged by the fact that both types of bat have the same mean body mass (5.5g) and only an 0.01m difference in the mean wingspan of the two. ~~They are~~ Both types are medium to dark brown in colour. This evidence also suggests they could be members of the same species so challenges the claim. **[6]**

11

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

challenge ~~support~~ : same mean body mass
similar wingspan
same colour
support : different range of echolocation
the habitats are different.
This shows the species would be adapted to different environments
species have same anatomical and physiological properties and can successfully interbreed. In terms of physical features they are almost identical but the habitat and behaviour is different, indicating they are different.

[6]

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(b)* The pipistrelle is the most common species of bat in Europe.

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

- Support ; differences are the range of echolocation (this is non overlapping) and habitat eg Common pipistrelle live in urban areas Soprano pipistrelle do not. Different range of echolocation - likely to eat different foods / have different mating habits.

- Against ; very similar habitat and mean wing span (0.22 m / 0.21 m) same colour & mean body mass → similarities due to same / similar genes so they are very closely related.

[6]

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14

(b)* The pipistrelle is the most common species of bat in Europe.

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

likely to be part of a different species because the range of echolocation differs from 52-60 to 42-47 making them likely to be different species also live in similar habitats ie. woodland, hedgerows and suburban areas. However have a very similar look ie 5.5g body mass and similar wingspan w/ 0.22m an 0.21m and a similar look with medium brown / dark brown ∴ likely not to be distinct species but a species very closely related.

[6]

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14

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

One could presume the ~~separate~~ organisms were different species because the mean wingspan of the common pipistrelle is 0.22 m while the soprano pipistrelle is 0.21 m. The soprano pipistrelle ~~also~~ also has a different pitched call (42-47kHz instead of 52-60kHz) ~~One can~~ There is also a reproductive ~~selective~~ barrier, as they live in different habitats, so there is potential for speciation and adaption. One could presume they are the same species because they have the same mean body mass (5.5g) and colour. ~~However~~ ~~It~~ It also cannot be confirmed whether the ~~one~~ 2 pipistrelle are different species because 2 ~~or~~ individuals have not been tested to see if they ~~produce~~ produce fertile offspring challenging the researcher's statement

[6]

15

14

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~~Can~~ Both are extremely simular in both weight and wingspan therefore simularity makes possibility of a distinct species harder as size hasn't changed when a reproductive barrier has occured. ~~Al~~ Along with the colourings which have remained the same as habitats are extremely simular. However the common pipistrelle have adapted a better echolocation at 52-60 kHz unlike the Soprano at only 42-47 kHz, making the possibility of a species which is distinct as this difference may have been caused by the environment and the range needed to communicate. **[6]**

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14

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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

They 2 species have identical mean body mass ~~and~~, colour and similar mean wingspans. This challenges the researcher's conclusion as ~~related~~ distinct species wouldn't show similar anatomical features or appearance. However, the 2 species have a varied range of echolocation call and habitat. This supports the conclusion as related bat species would have similar echolocation call ranges

[6]

(17)

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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On the one hand it is possible to say that they are different species due to the differance in range of echolocation call, common pipistrelle is 52-60 kHz compare to the much higher 42-47 kHz of the soprano pipistrelle, this difference is possibly due to the different habbitats. However, there is no evidence to suggest they cannot breed together to produce fertile offspring and as such a claim about whether they are different species or not cannot be fully supported by the evidence given. It would however be logical to suggest that the soprano pipestrelle is a sub species which could become distinct in the future.

[6]

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18

14

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both populations share similar features such as similar body mass, wingspan, colour, and most habitats are similar. The only difference is their hearing range ~~bxxl~~ which may be due to them having slightly different diets. Therefore they are highly likely to be able to interbreed as they are so similar both genetically and environmentally

[6]

19

14

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Table 5.1

A researcher made the following claim:

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The researchers claim could be supported due to difference of 5 in the highest & lowest of the range of echolocation call. Also soprano pipistrelle can survive in wetland whereas the common pipistrelle cannot so they must have evolved seperately to do so. However they can be seen as the same species due to the identical mean body mass, the extremely similar mean wingspan, their identical colours & the shared habitats of woodland, hedgerows & suburban areas

[6]

 H020/02

20

14

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Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

both have the same average body mass and wing span, however the range of echolocation is significantly larger for the common pipistrelle (52-60 kHz) than the soprano pipistrelle (42-47 kHz), this is a distinct difference. They both look the same but this characteristic differentiates them. They are also adapted to have slightly different habitats. Both can live in woodlands and hedgerows and suburban areas but the common pipistrelle can live in grassland, farmland and urban areas whereas the soprano cannot. **[6]**
The soprano can live in wetland and tree lines whereas the common soprano does not.

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21

14

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Table 5.1 shows information about two distinct populations of pipistrelle.

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

I disagree with the researcher from the evidence provided that they are two distinct species because it is clear they are very similar. A test needs to be done to determine if they interbreed to produce fertile offspring. Both bats have an identical body mass of 5.5g and a very similar wing span of about 0.215 m. They have the same colour and live in similar locations eg hedgerows. This shows they have common behaviour, appearence and features. However the range of echolocation is very different which could have been caused by a mutation

[6]

22

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

They have the same body mean mass, similar mean wingspan and the same colouring. However, their range of echolocation call ~~varies sig~~ differs significantly suggesting the ~~s~~ Soprano pipistrella has adapted to it's different habitats. The two ~~species tha~~ populations share several features so cannot be so distinct. There different habitats ~~implies~~ is likely to be the influence of their adaptations and selective pressures.

[6]

23

14

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Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The researcher claim is reliable as the two different bats groups have different ranges of echolocation call (one from 52-60 and the other from 42-47)

The two populations of bats also live in slightly different habitats (some common pipistrelle live in grassland while some common soprano pipistrelle live in wetland and parks

[6]

 H020/02

24

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The table suggests that both types of pipistrelle are similar in appearance, with similar body mass, wingspan and colour. Having a similar physical appearance ~~supports~~ challenges the idea that the 2 types are distinct species.

However, the common pipistrelle has a higher kHz and wider range of echolocation call and lives in drier woodland habitats. In contrast, the soprano pipistrelle has a lower kHz and smaller range of echolocation call, and lives in ~~welter~~ wetland habitats as well as drier woodlands etc. This data suggest the 2 may be different species after all. [6]

25

(b)* The pipistrelle is the most common species of bat in Europe.

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Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The Definition of a species is a group of organism whose members are similar to eachother in shape, biochemistry and behaviour. These two are the same shape with similar mean body mass and wing span. They also have a similar behaviour of a similar range of echolocation, only (10kHz) difference. they also are the same colours But the habitat is similar, yet slightly different this shows they are from the same species.

[6]

26

14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

The mean body mass in both bat species is the same, as it their colour. Their mean wingspan is also very similar, but not the same, providing evidence that they could be distinct species, or be the same. However, the differing range of echolocation and habitats suggests strongly that they are distinct species, because it suggests they hunt different prey and require different living conditions.

[6]

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14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	same · Mean body mass (g)	similar Mean wingspan (m)	diff Range of echolocation call (kHz)	same Colour	Habitat
Common pipistrelle	5.5	0.22	52 – 60	medium to dark brown	woodland, hedgerows, grassland, farmland, suburban and urban
Soprano pipistrelle	5.5	0.21	42 – 47	medium to dark brown	wetland, woodland edge, tree lines, hedgerows, suburban gardens and parks

Table 5.1

A researcher made the following claim:

'The common pipistrelle and soprano pipistrelle must be distinct species.'

Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

Both the common and soprano pipistrelle have similar physical characteristics, which challenges the researchers conclusion. e.g. the colour is the same, they have very similar mean wingspan (0.22 vs. 0.21) and the same mean body mass. A Species has usually evolved to have very similar or the same ~~for~~ ~~the~~ anatomy as they adapt to their environment but they could ~~so~~ have also evolved from a common ancestor and be different species, as they have slightly different habitats and different ranges of echolocation which suggests they could have different prey, and so are different species. The range for the soprano is lower (42-47) than common (52-60) and the soprano range is also smaller which could suggest they feed on different, fewer species of prey and have therefore adapted differently ~~habitat~~ for a different area!

[6]

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14

(b)* The pipistrelle is the most common species of bat in Europe.

Table 5.1 shows information about two distinct populations of pipistrelle.

Population	Mean body mass (g)	Mean wingspan (m)	Range of echolocation call (kHz)	Colour	Habitat
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Evaluate the researcher's claim by using the evidence in **Table 5.1** to support and to challenge the researcher's conclusion.

Evidence supporting:
- some different habitats e.g. wetland,
- different range of echolocation call
- very slightly different mean wingspan?

Evidence against:
- same mean body mass
- very very similar mean wingspan
- same colour
- several shared habitats

[6]

29

14

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They have similar colour, wingspan, and mean body mass - however when new technology was developed to calculate the range of echolocation call, it became apparent that this was a key difference. It is likely to two species are in the same genus. They live in some of the same habitats but common pipistrelles can live in suburban and urban areas, whereas soprano pipistrelle can live in suburban gardens and parks. However they do live in many of the same places so they could be the same species. [6]

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H022/02 Sample question paper – Question 1 Marks

Candidate Response	Mark
1	4
2	2
3	6
4	5
5	4
6	3
7	2
8	0
9	2
10	2
11	1
12	2
13	2
14	2
15	2
16	2
17	5
18	2
19	0
20	3
21	0
22	2
23	4
24	2
25	4
26	2

H020/02 Sample question paper – Question 2 Marks

Candidate Response	Mark
1	1
2	3
3	0
4	0
5	1
6	6
7	2
8	6
9	3
10	4
11	5
12	1
13	1
14	4
15	3
16	2
17	2
18	0
19	1
20	6
21	4

H020/02 Sample question paper – Question 3 Marks

Candidate Response	Mark
1	2
2	4
3	1
4	6
5	1
6	1
7	2
8	0
9	3
10	6
11	1
12	5
13	2
14	6
15	3
16	3
17	4
18	1
19	5
20	2
21	4
22	1
23	2
24	5
25	1
26	6
27	3
28	1
29	4

The small print

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