8223
Paper 2

General comments

Referring to the Namibian National Curriculum Guidelines, the following four points need to be highlighted:
The Namibian National Curriculum Guidelines:

- recognise that learning involves developing values and attitudes as well as knowledge and skills;
- provide insight and understanding of crucial global issues in a rapidly changing world which affect quality of life: the AIDS pandemic, global warming, environmental degradation, distribution of wealth, expanding and increasing conflicts, the technological explosion and increased connectivity;
- recognise that as information in its various forms becomes more accessible, learners need to develop higher cognitive skills of analysis, interpretation and evaluation to use information effectively;
- seek to challenge and to motivate learners to reach their full potential and to contribute positively to the environment, economy and society.

The questions in this paper required a very good understanding, of the topics covered, to be able to apply the learned subject content to relevant biological topics. Several learners managed this quite well.

Many candidates do not take enough time to READ the introductions to the questions as well as the questions with understanding. At this level of Biology candidates must be able to use the basic knowledge learned in class and select what is applicable to the answer for a question. The basic processes are the same in all living organisms and can ,therefore, be applied to all living organisms.

Use of language is an issue. **Punctuation rules** apply in all subjects. Candidates write sentences without capital letters at the beginning and any punctuation marks. Biological terminology must be used correctly and more care should be taken with spelling. Questions should be answered using full sentences, except when asked to list or state.

There have been scripts where correction fluid was used. This is NOT allowed.

Comments on specific questions.

The parts in *italics* represent the marking scheme.

Question 1

(a) (i) *11;*

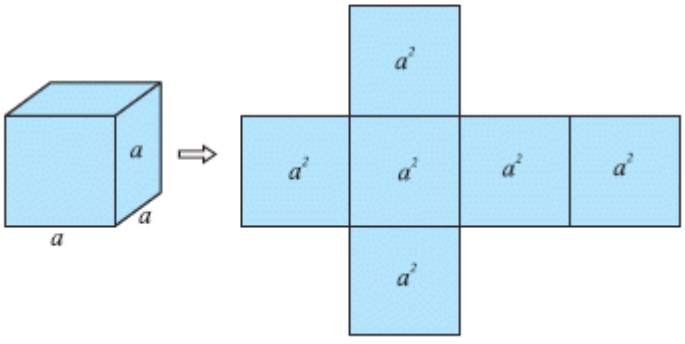
When measuring in millimeters, the ruler does not have the necessary accuracy to include decimals in the measurement. Candidates should therefore only state whole numbers.

(a) (ii) *Surface area = 726;*

When calculating the surface area of a cube, all 6 sides of the cube must be included. Most candidates just calculated the area of one face of the cube.

Surface Area of a Cube = $6a^2$

where a is the edge of the cube.



Volume = 1331

Most candidates calculated the volume correctly.

(b) (iii) *0.55 or 0.55 : 1;*

When a ratio is calculated the answer should always be in the simplest form. In this question candidates were asked to give their answer to 2 decimal places.
The order in which the ratio is given, in this case surface area: volume must be used in the answer as well. The 0.55 : 1 can be omitted, since the value is 1.

(b) *as cell size increases the surface area to volume ratio decreases; ora*

Accept: they are inversely proportional.

Candidates did not read which relationship was being referred to.
Candidates were struggling to express themselves and they tried to describe the relationship between surface area and volume of a cell which was a wrong explanation.

(c)
1. *substances / molecules / nutrients / wastes / gases / named substance;*
2. *(named substances) can only, enter / leave, through the, cell membrane;*
3. *diffusion is important to living cells / determines the rate of diffusion;*
4. *diffusion would be (too) slow if the surface area to volume ratio is (too) small; ora*
5. *AVP: e.g., implications to cell shape;*

Candidates did not know why surface area to volume ration is important to a cell, so many answered the question with reference to body size of multicellular organisms.

Surface area to volume ratio is important to the cell since the cell membrane is the only part where substances can enter or leave the cell. If this part is too small, too few substances can enter or leave the cell which will influence the efficient metabolism of the cell.

Candidates write about diffusion being easier in many of their answers. Diffusion cannot be easier; it can only be faster or slower.

Candidates could not relate the variation of surface area : volume to the changes in cell size and how this is linked to diffusion.

(d) *plant cells:*
root hair cell
adaptation: long (thin) extension / efficient absorption of mineral ions or water;

Accept more,maximum for efficient

epidermal cell
adaptation: flattened / reduce number of cells on the surface / shorter distance for light rays to travel;

palisade (mesophyll) cell
adaptation: elongated / arranged in columns / reduced number of cross walls (for maximum light absorption) / increased number of cells / can be packed into the leaf (for cytoplasmic streaming of chloroplast) ;

plant cell: phloem sieve tube element
adaptation: elongated / reduced number of sieve plates / efficient transport, of sugars / amino acids ;

plant cell: companion cell
adaptation: plasma membrane is folded to increase the surface area with proton pumps / cotransporter proteins

animal cell: squamous epithelial cell / endothelial cell
adaptation: thin / for short diffusion distance;

animal cell: epidermal cell, with brush border / with microvilli / lining the villi
adaptation: folds / efficient absorption of, nutrients / AW ;

animal cell: red blood cell
adaptation: biconcave disc / described / efficient, absorption / transport of oxygen ;

animal cell: (named) neuron
adaptation: long / thin / axon / dendrites / branched / efficient transmission of impulses / multiple connection points **;**

In this question the LIST rule is applied: the first response on the answer line is the only one marked.

Marks were awarded for the cell and its adaptation

If none of the adaptations was correct, one mark can be awarded for two correctly named cells.

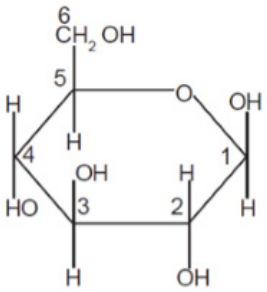
Candidates do not know the difference between organelles, cells and organisms.

The cells candidates should have listed, are those adapted by having an increased surface area to volume ratio, which means cells adapted for a role in absorption.

Microvilli / villi are not cells; microvilli are folds in the cell membranes of cells lining the villi (folds in the lining of the small intestine)

Question 2

(a) (i)



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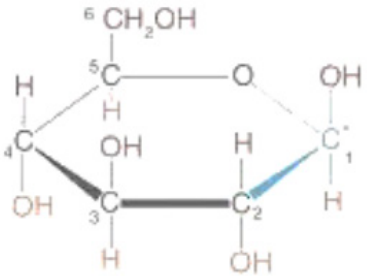


mp1 *correct location of oxygen bridge* — *Accept C1 to C5 as joined bonds (without C drawn)*
Ignore numbering of C atoms

mp2 *correct location of C6* ***Ignore*** *Atoms attached to C6*

mp3 *correct position of all H and OH*

Many candidates drew the molecule perfectly.

When drawing molecules in biochemistry, candidates should ensure that all atoms are included in the molecule. When a molecule is drawn in its ring form, the **C-atoms forming part of the ring** can be left out. The position of C6 and the bridging oxygen was often not indicated in the structure.

All the angles formed in the ring structure represent C-atoms, therefore, the O bridge must show the O atom in the correct position. All other atoms that are not part of the ring must be clearly indicated and the solid lines, indicating the covalent bonds must be drawn clearly.

(a) (ii) *in* **α** *I alpha glucose* **the** *OH / hydroxyl group on C1 / anomeric carbon, is below the plane of the ring; ora*

Most candidates know that they must refer to the position of the hydroxyl (−OH) group in the two molecules, but do not refer to which C atom this −OH must be attached to. Some candidates did not know the difference between a hydroxyl group (−OH) and a carboxyl group (−COOH). Reference was also made to single vs double rings. Both isomers of glucose have a single ring structure.

(b) (i) *P: ß-glucose / beta glucose ;* — *Accept on labelled diagrams*

Q: (beta 1-4) glycosidic bond ; — *Accept: β glucose / B glucose*

Well answered by most candidates. A number of candidates referred to an oxygen bridge, which can occur in a number of different bonds, therefore, the answer had to refer to the specific bond found between monosaccharides.

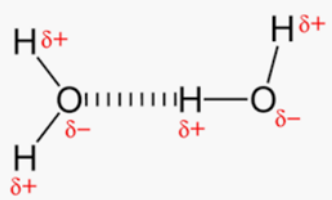
(b) (ii) *maintains structure / stability, of cellulose ;*

The hydrogen bonds do not join the β glucose monomers in the chain that forms the unbranched cellulose molecule.

(b) (iii)
1. *water is a polar molecule ;*
2. *oxygen (atom) is slightly negatively charged / hydrogen (atom) is slightly positively charged ;*
3. *uneven sharing of electrons between the oxygen atom and hydrogen atoms / AW ;*
4. *(weak electrical attraction / hydrogen bond) between a hydrogen in one molecule and the oxygen in another molecule ;*
5. *hydrogen and oxygen (atoms) are covalently bonded together within one water molecule ;*

Accept: ***MP1*** *water is a dipole*
MP2 *oxygen (atom), is delta negative / electro-negative*
MP2 *hydrogen (atom), is delta positive / electron- positive*
Reject *ions*

Annotated diagram may be used



Candidates are not sure as to what an ion, an atom or a molecule is. These terms were used incorrectly.

Candidates also confuse the **covalent bonds** between the oxygen and two hydrogen atoms **in** the water molecule and the **hydrogen bonds between** the water molecules.

In the water molecule, the atoms are covalently bonded. Due to the difference in electronegativity (the tendency of an atom to attract a shared electron) the electrons shared between the oxygen and hydrogen atoms in the water molecule, are pulled more towards the nucleus of the oxygen atom, making the region around the oxygen atom more negative than the areas around the hydrogen atoms which become more positive.

The charges in these areas are not complete charges, that is why it is important to refer to slight positive or negative charges.

The slight negative charge of the oxygen atom in water attracts the slight positive charge around the hydrogen atoms in another water molecule.

The question was about how this bond is formed, not where it plays a role in the life of a plant or in determining the properties of water.

Question 3

(a) (i) *neutrophil ;*
(multi-)lobed nucleus ;
granules / vesicles / lysosomes, in cytoplasm ; *Ignore ref, to enzymes / ribosomes*

Most candidates recognised the cell as a neutrophil or a phagocyte. Reasons were also given correctly by most. Enzymes and ribosomes were rejected because they are too small to be seen.

The neutrophil has a lobed nucleus, not 3 nuclei. The different white blood cells are easiest identified by looking at the structure of the nucleus and associated organelles.

Candidates did not read the question and referred to the functions of the cell.

(a) (ii)
1. *non-specific / innate, primary immune response ;*
2. *engulf (named) pathogens / endocytosis ;*
3. *formation of a phagosome / vacuole surrounding pathogen ;*
4. *fusing of lysosome with phagosome / digest / hydrolysis, <u>pathogens</u> (using hydrolytic enzymes) / ref. to phagocytosis ;*

Accept:
MP1 *identify <u>non-self</u> antigens (on pathogens)*
MP2 *swallow / eat (pathogens)*
Ignore *microorganisms*
ECF *lymphocyte in (a)(i) produce antibodies*
Accept *breakdown for hydrolysis*
Ignore *destroy / kill, pathogen unqualified*
Ignore *fights pathogen*

Most candidates answered this question correctly. Mention of a foreign substance and antigen, instead of a pathogen is not accepted.

The question was: Describe the role in immunity of the type of cell shown in Fig. 3.1.

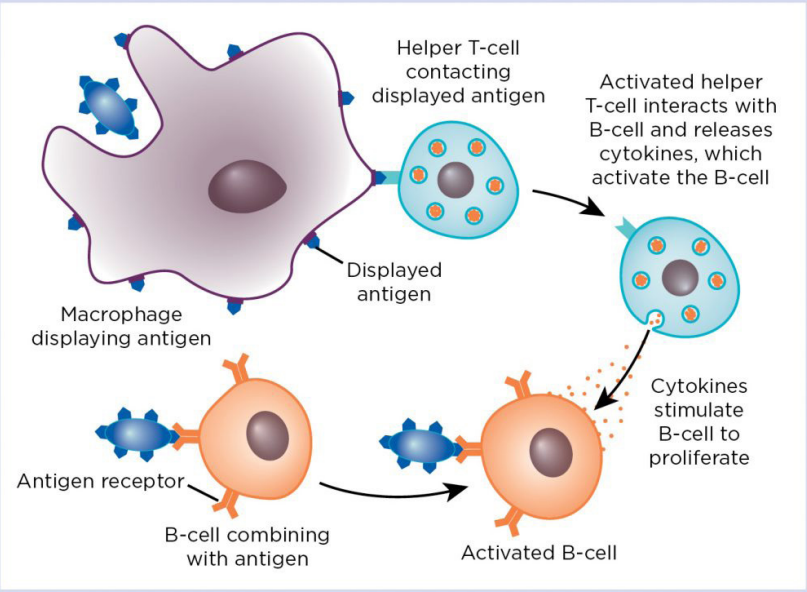
Immunity is the ability to resist a particular infection, therefore, the candidates were expected to describe **how** this cell helps the body to resist a pathogen.

The involvement of the phagocytes in the non-specific immune response was rarely mentioned by candidates.

(b) (i) *(macrophages) present the antigen on their cell surface membrane ;*
they activate T-helper cells ; *Accept: antigen presenting cell*
T-helper cells / T-lymphocytes produce cytokines;
cytokines stimulate (specific) B-lymphocytes to divide by mitosis / clonal expansion ;
Accept: (specific / activated) B-lymphocytes are cloned
Ignore ref. to memory cells / antibodies

Most candidates struggled to answer this question.

Fig 2. **Immune reactions inside a lymph node**



The macrophage does not display debris of the pathogen, but the antigen of the pathogen and this is done in its cell membrane.
This display of the antigens activates the T-lymphocytes / T Helper cells to release the cytokines which then stimulate the B-lymphocytes to divide by mitosis.

(b) (ii)
1. *memory cells ;*
2. *ref. to providing long term immunity / stay in body for a long time;*
3. *triggers a secondary (immune) response ;*

4. *plasma cells ;*
5. *produce / secrete antibodies;*
6. *antibodies, facilitate agglutination precipitation / neutralization / lysis of pathogens and their toxins ;*
7. *ref. to specific immune response ;*

Accept: 2 marks for naming cells
***MP2 Ignore** 'remembers' pathogen*
***MP3 Accept** multiplies immediately and produces more on further infection by same pathogen / reduces chance of symptoms a second time*
***MP6 Accept** description of role of antibodies (e.g. mark pathogens)*

Mostly well answered, although some candidates listed antibodies in such a way, that it gave the idea that they were cells formed by the cloning of the B-lymphocyte. Candidates do not understand that it is the B-lymphocytes which are cloned to form plasma cells and not the plasma cells themselves. The plasma cells only form antibodies.

Question 4

(a) (i) ***R**: alveolus ;*
***S**: bronchiole ;*

The candidates struggled to interpret the photomicrograph.

(a) (ii) *1. correct ref to diffusion of carbon dioxide / oxygen ;*
2. thin layer of epithelium / alveolar wall / one cell thick wall, for shorter diffusion distance ;
3. surrounded by many blood capillaries / network of capillaries, to maintain concentration gradient ;
4. layer of moisture inside alveoli for gases to dissolve in for faster diffusion ;
5. surfactant prevents alveoli from sticking together / closing AW ;
6. ball / rounded shape, to increase surface area **(for gaseous exchange);**

Accept:MP2 *only when linked thin wall to short diffusion distance*

Apply ECF for incorrect identification of R

If candidate is describing an alveolus (even though it has been wrongly identified), use mp 1- 5.

MP2 Reject *thin cell wall*

Ignore *reference to elastic fibres throughout*

Due to the inability to interpret the photomicrograph, candidates also struggled with this question.

In this question it is important to note that the adaptation was only about how structure R, on alveolus is adapted to **gaseous exchange.**

Most candidates had some ideas of how to answer the question, but their answers were incomplete, as they did not include an explanation of the adaptation.

(a) (iii) *stretch / expand, during inspiration AW (to increase surface area) ;*
recoil / shorten, on expiration to help, expel air / increase pressure ;
prevent bursting of ***R*** *;*

Ignore *contract / relax*
Accept *withstand high pressure*

Also in this question, the wrong identification of R made answering this part very difficult. Ecf were awarded.
The elastic fibres do not prevent the alveoli from collapsing, they just allow it to stretch during inhalation and recoil during exhalation.

(b) *breathlessness / shortness of breath / frequent chest infections / difficulty in breathing / wheezing sound when breathing / mucus produced when coughing / productive / persistent, cough / fatigue / coughing blood ;*

Mark as list

Accept *inflammation of gas exchange structures*

Ignore *coughing unqualified*

Reject *chronic bronchitis*

Most candidates answered this question well; coughing, however, had to be qualified, i.e. described.

Question 5

(a) *Y: centromere ;*
Z: (sister) chromatids ;

Candidates answered this question quite well. Some confused centromeres with centrosomes and some candidates did not know the difference between chromatin and chromosomes.

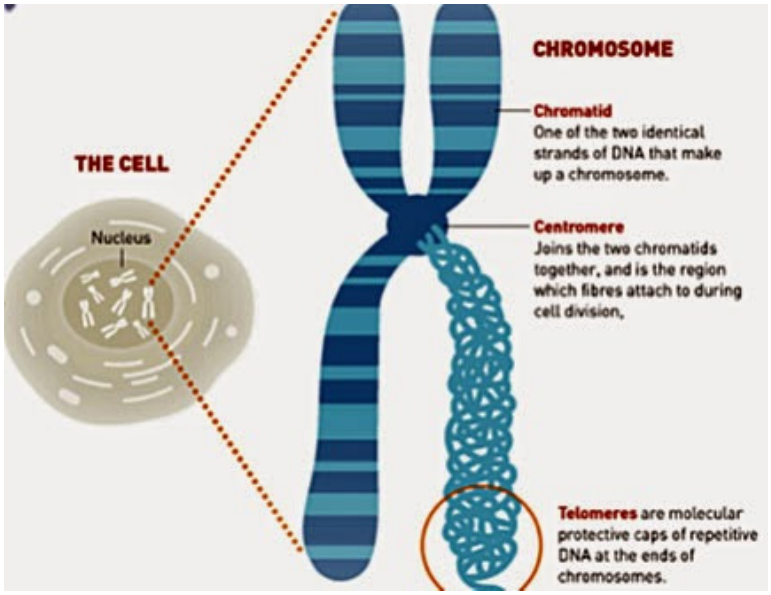
The two sister chromatids were often labelled as telomeres. The position of the telomeres is important, but since the label was provide**d at the top of the diagram, it could not be accepted as an answer to this question.**

(b) *1. (specialized DNA) cap at (both) end(s) of the, chromatids / chromosomes ;*
2. consists of many repeats of the same short DNA sequence ;
3. (repeated DNA sequence is) TTAGGG ;
4. prevents the loss of genes (at the ends of chromosomes) / loss of genetic information ;
5. continuous, DNA replication / cell division ;
6. prevents unnecessary recombination of DNA; AW

Most candidates knew where the telomeres are found but were unable to describe what a telomere is.

MP 6. It is the DNA molecules that would get stuck to each other during the replication process, not the chromosomes.

Many learners referred to telomeres as being plastic, or a hard structure at the end of chromatids. This is an incorrect interpretation of the comparison to shoelaces. Telomeres consist of DNA nucleotides, just like those that form part of the genes in the chromatid.



(c) *(telomeres) are worn down / become shorter / parts are lost (each time DNA replication takes place);*

***Accept** disappear / degenerate*
***Reject** thinner / die / become fewer / degrade*

Most candidates answered this correctly.

(d) *telomerase replaces the telomere sequence on the chromosomes / AW ; ora*

(higher telomerase concentration) allows for faster formation of telomeres ; ora

allows, uncontrolled / continuous, cell division / mitosis ; *Accept: cell replication*
prevents cell death / apoptosis (of cancer cells) / telomerase allows cancer cells to survive / prevents cell aging ;

Candidates struggled with this interpretation of the function of the telomeres.

The telomeres in healthy cells become shorter and this eventually leads to cell death / apoptosis.

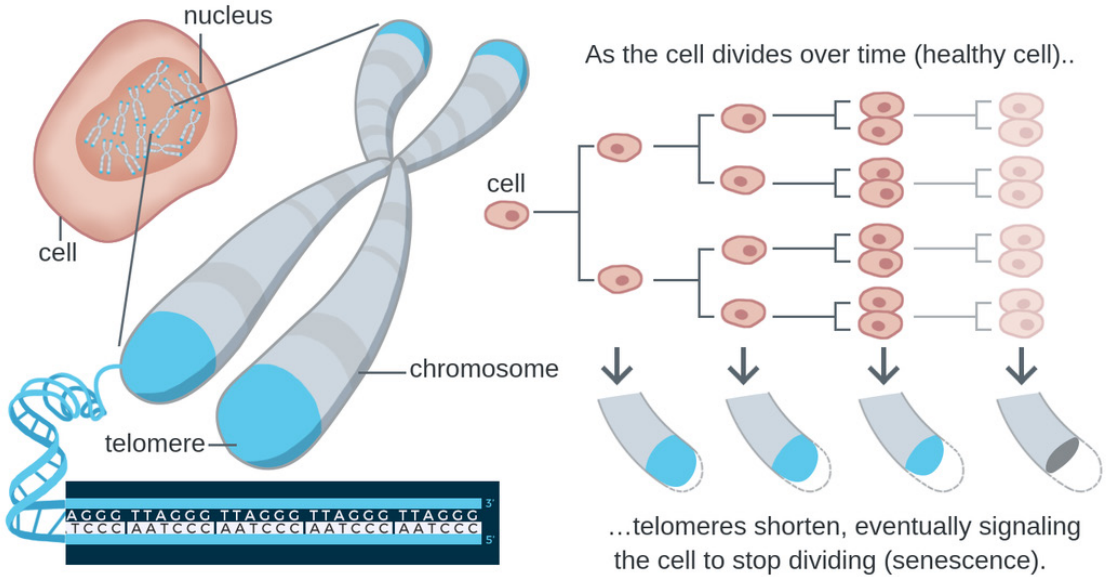
If the enzyme telomerase replaces the lost telomeres, they do not shorten as quickly and, therefore, there will be no cell death. The number of telomeres does not increase: the lost ones are just being replaced. The introductory statement about the enzyme telomerase: "Telomerase is an enzyme that catalyses the formation of telomeres", was misinterpreted as the breakdown of telomeres.

If there is no cell death, cells will continue to divide uncontrollably and this is what forms the tumour.

Many candidates assumed that the enzyme telomerase was responsible for increasing the rate of cell division / mitosis, which is not correct.

Some candidates struggled with the idea of cell growth and cell division.

The following diagram shows what happens to the telomeres in a healthy cell over time. When hardly any telomeres are left, the cell stops dividing and this leads to cell death.



Question 6

(a) (i) Due to a problem with the information provided in the question, the first row in the table was ignored and not marked. Question 6(a), therefore, was marked out of 1 and not 2.

substances transported	*process*	*supporting evidence*
mineral ions	*two / 2*	*against a concentration gradient / from a low to a high concentration.*

Candidates did not follow the instructions in the question and wrote the name of the process into the column with the heading “process”, which did not qualify for a mark. Candidates also just referred to there being a low concentration outside the cell and a high concentration inside the cell, instead of stating what happens in the process.

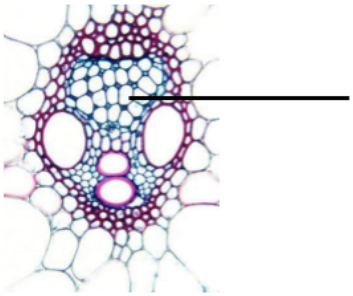
(a) (ii)
1. *water is absorbed by osmosis / mineral ion absorbed by active, transport / uptake ;*
2. *active, transport / uptake against a concentration gradient, requires energy (from respiration);;*
3. *(osmosis/diffusion is a) passive process / uses kinetic energy (only) ;*
4. *the water uptake will continue at the same rate and the mineral uptake will, decrease /stop ;*

Reject: energy is produced (in respiration);
Accept: ATP is produced (in respiration)

This question was clearly about the effect of the toxin on the **absorption** of water and mineral ions. Many candidates referred to the role of these substances in the cell / plant, instead of concentrating on the absorption of these substances. Candidates also did not recognise the link between no respiration taking place, therefore, a lack of energy and the method used in the absorption of water and mineral ions by the plant root.

Active transport as evidence for process 2 is not correct, since the diagram does not show any evidence of active transport, the diagram only shows the relative concentration of substances.

(b) (i)



phloem / any indication pointing to the correct tissue;

A label line must be used and the correct name provided;

Accept phonetic spelling

Candidates did not interpret the cross-section correctly.
When asked to label a diagram, it is not sufficient to just draw a label line to the correct tissue, a **label** must also be provided

(b) (ii) *translocation*

This part of the question was mostly answered correctly. There were, however, also a number of candidates who referred to processes such as translation / diffusion / active transport.

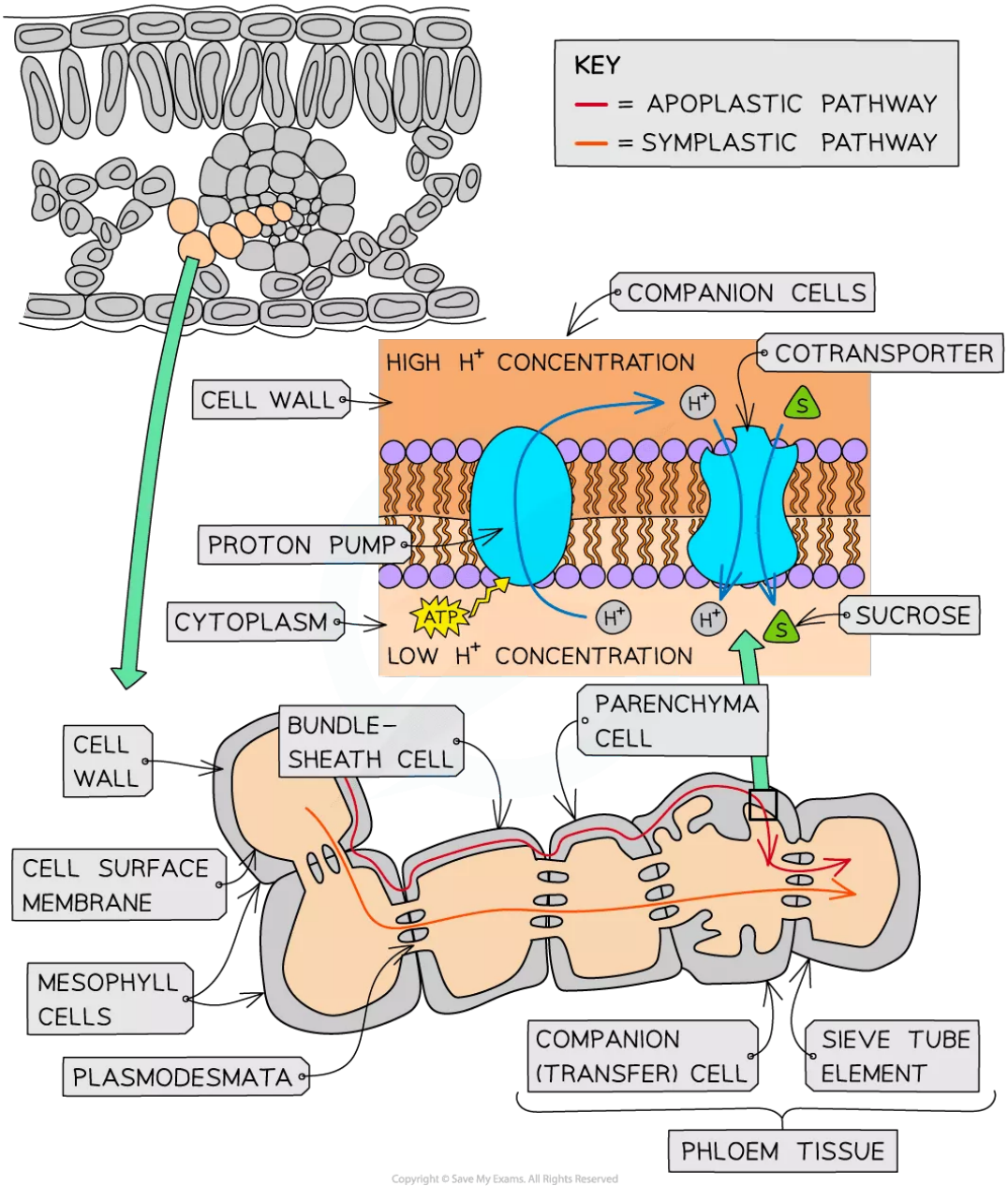
(b) (iii)
1. *protons are actively transported out of companion cells;*
2. *ref to proton pumping ;*
3. *(active transport of protons) creates a proton gradient (between the cell wall and the cell) ;*
4. *cotransport of sucrose and hydrogen ions (in cell surface membranes of companion cells) ;*
5. *(high concentration of) protons move, along with / drive, sucrose, into the companion cell / via co transporter mechanism ;*
6. *sucrose moves (through plasmodesmata) from companion cells into the phloem sieve tube ;*

Accept: hydrogen ions / H^+ throughout

Accept: phloem cells for companion cells throughout

MP 3: high concentration of protons in cell wall / outside cell / creates a proton gradient

Most candidates described the process of translocation (mass flow hypothesis) in this part of the question because they did not read the phrase **"loaded into the tissue"**. Many candidates lacked the knowledge of the basic biochemical details.



The question required a description of the part circled in the diagram.
Many candidates refer to the hydrogen ions bonding with the sucrose which is incorrect.