



## Solution Pathway

**NOTE: This task is sold on condition that it is NOT placed on any school network, student management system or social media site (such as Facebook, Google Docs, etc.) at any time.**

**NOT FOR PRIVATE TUTOR USE.**

Below are sample answers. Please consider the merit of alternative responses.

### Section A: Multiple Choice question

Question	Answer	Notes
1	B	Both eukaryotes and prokaryotes (pictured in Figure 1) are encapsulated in a cell membrane.
2	D	A is interphase, E is prophase, I is mitosis and C is DNA synthesis/replication.
3	C	F represents metaphase, the phase of mitosis when sister chromatids line up along the equator.
4	D	Precision refers to how close measurements of the same item are to each other. If the experiment calls for the 'repeated' measurement of water in a volumetric cylinder, ensuring readings are always taken from the bottom of the meniscus ensures each measurement is as close to the calibrated measure as possible.
5	B	Xylem is a tissue which helps to transport water and nutrients in a plant. The movement of water and nutrients in the xylem is unidirectional. The conducting cells in xylem are dead, and the xylem provides structural support to the plant.
6	D	The organ is a kidney – part of the excretory system. The function of the kidney is to cleanse the blood of toxins and excess fluid and excrete this waste through urine.
7	B	The ureter connects the kidney to the urinary bladder.
8	A	The folds, called cristae, increase the surface area to volume ratio of the inner membrane.
9	A	This is the stages of apoptosis. At '3' the nucleus begins to break apart.
10	D	A bleb is an irregular bulge in the plasma membrane caused by a breakdown in the cytoskeleton of a cell.
11	D	This is an electron micrograph of a prokaryote undergoing binary fission.

12	C	J – Prophase, L – Metaphase, H – Anaphase, I – Telophase, K – Cytokinesis.
13	D	L is metaphase during which chromosomes align along the metaphase plate.
14	C	All five images represent the stages of mitosis.
15	B	This is part of the hyperthyroidism feedback loop and the hormones involved are TRH, TSH, T3 and T4.
16	A	Hyperthyroidism is the overproduction of the hormone thyroxine by the thyroid gland.
17	A	This is a pore or channel protein.
18	A	X is the plasma membrane which is comprised of a phospholipid bilayer.
19	C	Nutrients are absorbed by the small intestine, whilst water is absorbed by the large intestine.
20	C	Stomata open during photosynthesis which usually occurs during the daytime.
21	C	Insulin is a signalling hormone, secreted by the pancreas. It signals to muscle, fat and red blood cells.
22	B	Embryonic stem cells are totipotent, derived from blastocyst cells and can differentiate into any cell type.  Adult stem cells are pluripotent, derived from bone marrow and give rise to limited cell types.
23	C	C is an example of human error and the most likely reason of the four provided that the potato cube shrunk, as the solution concentration of the NaCl should have been consistent over the four samples of potato.
24	A	This is the sample with the highest SA:V ratio.
25	C	This is a chloroplast, found in eukaryotes and bound by a double membrane.

**Section B: Short Answer****Question 1** (5 marks)

- (a) *Cytokinesis* (1 mark).
- (b) *'B' is in telophase, during which the nuclear membranes form around the separated chromosomes* (1 mark), *whereas 'C' is in anaphase, during which the chromosomes have almost reached their respective poles* (1 mark).
- (c) *During prophase* (1 mark) *the centrioles move apart and the nuclear membrane disintegrates* (1 mark).

**Question 2** (5 marks)

- (a) *This is the image of plant cells* (1 mark).
- (b) 1 mark for correct identification of process. 1 mark for description of process.

*These cells reproduce via mitosis* (1 mark). *Part of the cell cycle, mitosis is the process of nuclear replication and division that results in two identical daughter cells* (1 mark).

- (c) Any two plausible answers for 1 mark each for example.
  - *Prokaryotes have no membrane bound nucleus, eukaryotes do.*
  - *Prokaryotes are usually small in comparison to eukaryotes.*
  - *Prokaryotes are mostly single celled organisms, whilst eukaryotes are mostly multicellular.*

**Question 3** (8 marks)

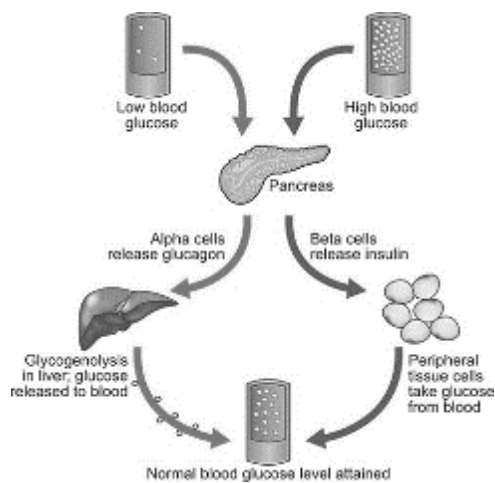
- (a) *Cancer* (1 mark).
- (b) Any plausible response (1 mark) and a link to the image provided (1 mark).

*Cancer cells are varied in size and shape* (1 mark) *and a cluster of non-uniform cells can be seen in the top part of this image* (1 mark).

- (c) *In multicellular organisms, cells that are no longer needed or are a threat to the organism are destroyed through programmed cell death or apoptosis* (1 mark). *Apoptosis is mediated by enzymes called caspases, which trigger cell death by cleaving specific proteins in the cytoplasm and nucleus* (1 mark). *The activation process is initiated by either extracellular or intracellular death signals, which cause intracellular adaptor molecules to aggregate and activate procaspases* (1 mark).
- (d) *Cancer is a condition where too little apoptosis occurs* (1 mark), *resulting in malignant cells that will not die* (1 mark).

**Question 4** (8 marks)

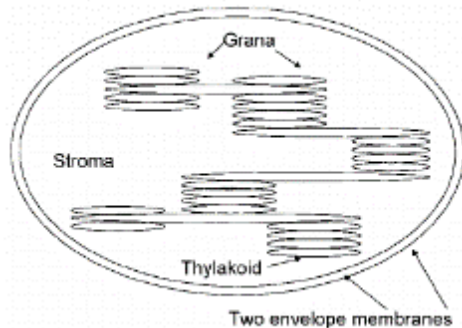
- (a) *A scientific model is a representation of a system of ideas, events or processes* (1 mark).
- (b) *The purpose of a scientific model is to help make the invisible visible, thus rendering scientific phenomena easier to visualise and understand* (1 mark).
- (c) *A scientific theory can be considered as the answer to a particular scientific problem* (1 mark) whilst *a scientific model can be considered as a representation created in order to explain a theory* (1 mark).
- (d) Any model that represents blood sugar control and includes
- The correct organs involved (1 mark).
  - The correct hormones involved (1 mark).
  - The feedback associated with AT LEAST one of high or low blood glucose levels (1 mark).



- (e) *An individual suffering from severe hypoglycaemia may experience double or blurry vision* (1 mark).

**Question 5** (4 marks)

- (a) 1 mark for correctly identifying two membranes, 1 mark for correct labelling of grana/granum and thylakoid, 1 mark for correctly labelling stroma.



- (b) *The purpose of chlorophyll is to absorb light energy* (1 mark).

**Question 6** (9 marks)

- (a) Any answer that correctly predicts the impact of the IV (1 mark) on the DV (1 mark).

*The plant that will lose the most mass* (1 mark) *is the plant that is subject to wind as wind is the most desiccating environmental factor* (1 mark).

- (b) Any answer that correctly distinguishes between a method (1 mark) and a methodology (1 mark).

*The term 'methodology' describes the theoretical or contextual approach that the researchers may take and are usually applied in the early stages of research* (1 mark) *whereas the term 'method' describes the tools or steps applied to gather data during a later part of research* (1 mark).

- (c) Any three plausible responses that show a correct interpretation of the provided data.

*Exposure to light increases the rate of transpiration, as the plant with exposed to constant light lost mass at a greater rate than the plant that did was kept in the dark* (1 mark).

*The impact of exposing a plant to constant light is similar to the impact of exposing a plant to constant wind* (1 mark).

*Providing a plant with a humid environment may create an equilibrium between the loss of water and the uptake of water as the percentage change in mass of the plant was almost negligible when compared to the percentage change in mass of plants subject to the other environmental factors* (1 mark).

- (d) *Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers* (1 mark).

- (e) Any plausible random error (1 mark).

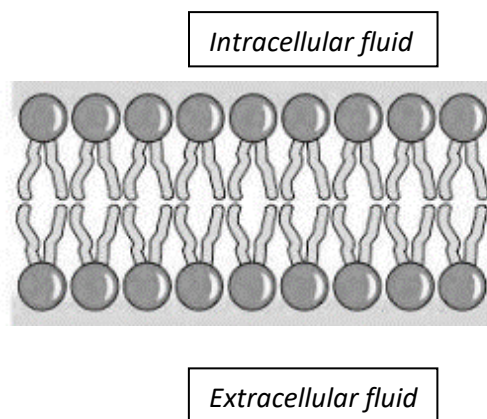
*The control plant may have been subject to environmental factors such as wind and fluctuating light across the course of the experiment (1 mark).*

**Question 7** (7 marks)

- (a) *The mitochondrion is responsible for generating ATP, which provides the cell with chemical energy (1 mark). As our muscles are responsible for locomotion, they require a larger amount of ongoing energy than our skin (1 mark).*
- (b) *That is a misinterpretation of the graph – as it represents each skin cell and shows that, on average, a skin cell has approximately 300-500 mitochondria (1 mark). All eukaryotic cells contain mitochondria as all cells need chemical energy to function (1 mark).*
- (c) *Active transport (1 mark).*
- (d) *A system is an organisation of varying numbers and kinds of organs (1 mark) so arranged that together they can perform complex functions for the body (1 mark).*

**Question 8** (4 marks)

- (a) *The phospholipid bilayer (1 mark).*
- (b) *Phospholipids spontaneously arrange into a bilayer. The two hydrophilic head regions associate with the intra- and extra-cellular fluids (1 mark) whilst the hydrophobic tail regions face inward (1 mark).*
- (c) 1 mark for showing that fluid would be found on either side of the bilayer.



**Image References**

**Section A**

Figure 1: <https://www.istockphoto.com/photos/prokaryotic-cell>

Figure 2: <https://www.studocu.com/en-us/document/wake-forest-university/biomechanics-of-human-movement/mitosis-worksheet-key-njkelwbqfgklberivlbiqtbguieabnvaenvje/18562611>

Figure 3: <https://www.ck12.org/book/ck-12-biology/section/23.4/>

Figure 4: <https://sites.google.com/site/rickardearth/using-a-graduated-cylinder>

Question 7: <https://www.twinkl.co.uk/resource/anaerobic-respiration-equat-colouring-sheet-t-tp-2673026>

Figure 5: <http://www.abnova.com/support/resources.asp?switchfunctionid={CBB86AB6-2EA6-422F-BBBD-1CB8B9DCE6FA}>

Figure 6: <https://www.thoughtco.com/bacterial-reproduction-373273>

Figure 7: <http://chengmoh.blogspot.com/2011/05/answers-to-mid-year-biology-paper.html>

Question 20: <https://www.shutterstock.com/search/stomata+plants>

Figure 8: <https://www.pinterest.com.au/pin/46936021090773278/>

**Section B**

Figure 1: <https://www.thoughtco.com/observing-mitosis-lab-1224888>

Figure 2: <https://www.shutterstock.com/video/clip-1040361668-chloroplast-eukaryotic-cell-seamless-animation-under-microscope>

Figure 3: <https://www.quora.com/What-do-cancer-cells-look-like-in-a-microscope>

Figure 4: <https://www.dreamstime.com/water-h-o-molecular-model-three-representations-d-skeletal-formula-space-filling-ball-stick-atoms-represented-as-spheres-image188414519>

Question 6: <https://sites.google.com/site/emiliephansciencelab/transpiration-lab>

Figure 5: <https://brainly.in/question/6496008>

**Solution Pathway**

Question 4: <https://www.endocrineweb.com/conditions/diabetes/normal-regulation-blood-glucose>

Question 5: <https://ibguides.com/biology/notes/photosynthesis-hl/>