HERITAGE COLLEGE

A CHRISTADELPHIAN SCHOOL

ADELAIDE, AUSTRALIA

STAGE 1 BIOLOGY

FORMATIVE SACE TEST

TOPIC: CELL BIOLOGY

NAME_____

DATE_____

Stage 1 Biology

FORMATIVE CELLS TEST MARKSHEET

Specific features		**Grade**	**Comments**
IAE3	*Analysis and interpretation of data and evidence to formulate and justify conclusions*		
KA1	*Knowledge and understanding*		
KA2	*Development and application of biological concepts*		
KA4	*Communication of knowledge*		

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STAGE 1 BIOLOGY
FORMATIVE SACE TEST

TOPIC: CELLS

Multiple Choice Answer Sheet

1. Show your answer to each question by drawing a bubble over the correct answer like this:

2. No marks can be awarded for a question that has more than one answer. If you change your mind, ensure that your final choice of answer is perfectly clear by crossing out your previous choice like this:

1	J	K	L	M	**9**	J	K	L	M
2	J	K	L	M	**10**	J	K	L	M
3	J	K	L	M					
4	J	K	L	M					
5	J	K	L	M					
6	J	K	L	M					
7	J	K	L	M					
8	J	K	L	M					

Formative Test 1

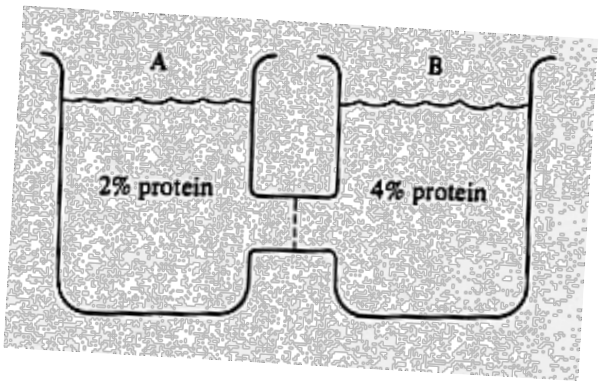
Cells & Life

Part A – Multiple Choice

1. Compared to cells, pure water is always

   J isotonic.
   K hypertonic.
   L hypotonic.
   M hyperactive.

2. Examine the diagram below. The two beakers are joined by a connecting tube that has a membrane in the middle. The membrane is **impermeable** to protein.



   Which statement is correct?

   J Water will only move from B to A.
   K Water will only move from A to B.
   L Water will move both ways, but the net flow will be from B to A.
   M Water will move both ways, but the net flow will be from A to B.

3. Which is the correct process for the cell to synthesis proteins?

   J RNA → DNA → amino acid chain
   K DNA → amino acid chain → RNA
   L RNA → mRNA → amino acid chain
   M DNA → RNA → amino acid chain

4. A liver cell has been stimulated by the body to produce a certain type of protein and transport it to the outside of the cell. Which of the following sequences correctly describes, in order, the major organelles and processes involved in creating and transporting the protein?

J ER; cell membrane, transport vesicle; nucleus
K Ribosome; ER; Golgi body; nucleus
L Golgi body; ER; ribosome; cell membrane
M nucleus; ribosome; ER; Golgi body

5. Which one of the following combinations correctly identifies a cellular structure, its function, and the type of cell in which it can be found?

	Cellular structure	**Function**	**Type of cell in which it is found**
J	Circular loop of DNA in cytoplasm	Contains information for the synthesis of proteins	Eukaryotic
K	Ribosome	The site of protein synthesis	Prokaryotic
L	Linear DNA	Contains information for the synthesis of mRNA molecules	Prokaryotic
M	Smooth Endoplasmic reticulum	The site for the re-packaging and secretion of proteins	eukaryotic

6. Which of the following is NOT a typical characteristic of living things?

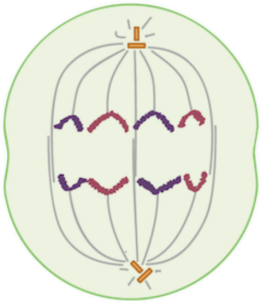
J multicellular
K able to reproduce
L grow
M homeostasis

7. Which statement is true regarding prophase in mitosis?

J chromatin is further condensed into visible structures
K chromatin is unwound from histones
L DNA condenses into chromatin
M DNA becomes less visible in the cell

8. Examine the diagram (below right) of a cell undergoing mitosis. Which statement best describes what is happening in the cell?

J Metaphase; chromosomes lining up at equator
K Anaphase; sister chromatids separating
L Anaphase; homologous chromosomes separating
M Metaphase; chromosomes condensing



9. If the base sequence of the template DNA strand is AGT…

J the codon would be TCA.
K the rRNA would be AGU.
L the transfer RNA would be UGT.
M the mRNA would be UGT.

10. Which organelle is <u>most directly</u> involved with protein **synthesis**?

J Golgi body
K Ribosome
L Rough ER
M Lysosome

Part B – Short Answer Questions

1. The early theory of '**Spontaneous Generation'** suggested that living organisms like flies can spontaneously appear from dead materials (eg. dirty rags; old meat; etc). How does the **Cell Theory** contradict this idea?

(1)

2. Choose either **chloroplast** or **mitochondria** (of the two) and circle it in this question. For the one you circled…

A. Describe its **structure** (can use diagram and labels to help)

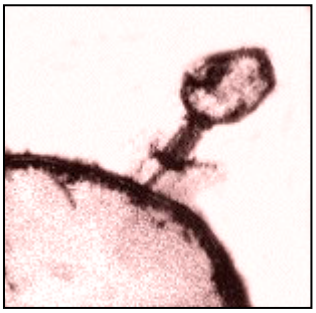
(2)

B. Explain how its structure helps it's **function** in the cell.

(2)

3. Below is an image of a virus (phage) attacking a bacterial cell. Some scientists have argued that viruses are <u>not living things</u>. Give two good reasons they might use to support this view, given the 7 Characteristics of Life.

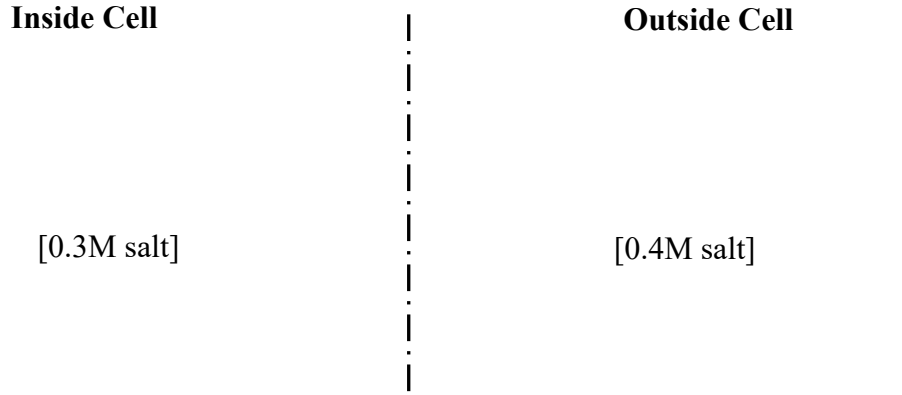
(2)



4. A cell will have different amounts of DNA in its nucleus between the G_1 phase and G_2 phase of its cell cycle. Explain why this is the case AND the importance of this for the cell.

(2)

5. Below is a diagram of a selectively permeable membrane of a cell.



a) Use an arrow to draw on the direction of **osmosis**.

(1)

b) If salt were to move by **diffusion**, which direction would it move?

(1)

c) Has this cell been placed in an isotonic, hypertonic, or hypotonic solution?

(1)

d) Explain what you would expect to happen to this cell over time.

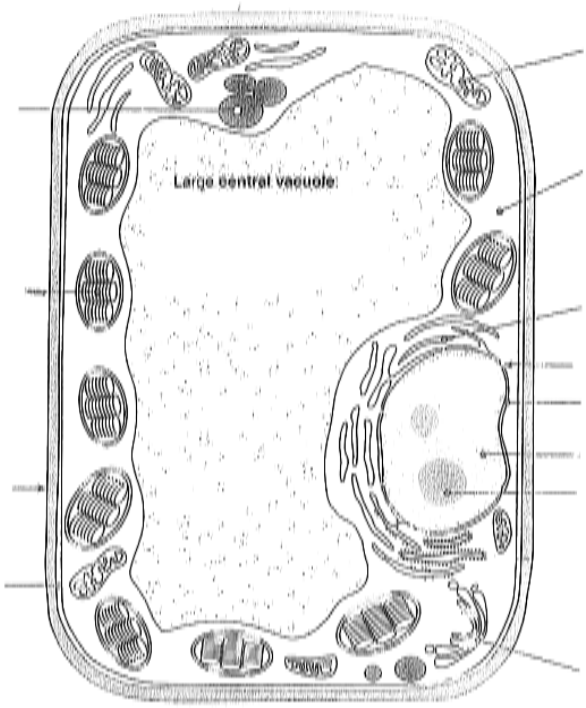
(1)

e) Explain one way you could increase the concentration gradient.

(1)

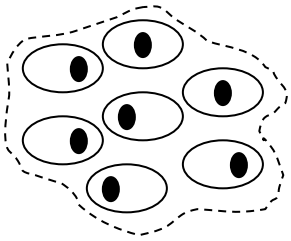
6. On the diagram below, label 4 key organelles.

(4)

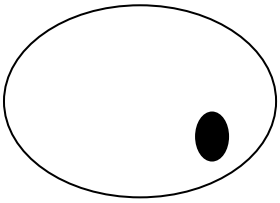


7. The following diagrams represent two organisms of the same volume, but one is multicellular, and one is unicellular.

Organism 1



Organism 2

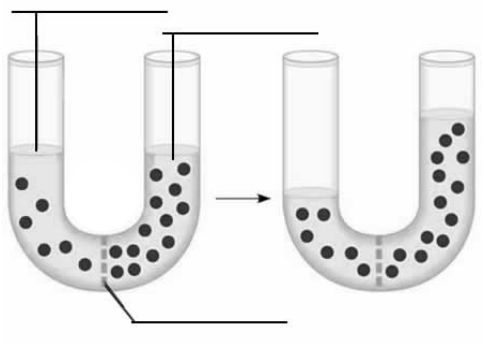


Which organism will be more efficient at diffusing water and nutrients to its insides? Explain your answer by referring to the diagrams (or even drawing on/labeling them).

(2)

8. Below is a diagram of a u-tube before and after 10 minutes of observation. The tube is filled water that has solute particles in it (black dots).

Before



After

a) Place the following 3 labels on the diagram: *hypertonic, hypotonic, dividing membrane.*

(1)

b) Explain why the volume has increased on the right-hand side.

(2)

c) Could the *dividing membrane* be described as 'selective'? Explain.

(2)

9. ATP is a molecule that cells synthesize constantly, and it is crucial for all life functions in the cell.

   a) Explain how the structure of the mitochondria helps with highly efficient production of ATP molecules in the cell.

   (1)

   b) Draw a diagram to show how an ATP molecule would help a protein in moving a molecule across a membrane. Label all parts.

   (3)

   c) Explain how ATP molecules are like a rechargeable batteries for the cell.

   (2)

10. In question 6 above, you labeled 4 key organelles. In the space below rank these 4 that you labeled in order of what you could argue to be the 'most important' = 1, to the 'least important' = 4, in terms of cell survival.

Ranking: 1. 2. 3. 4.

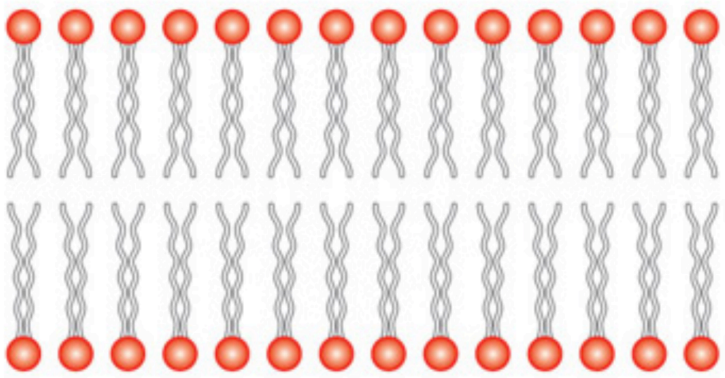
Now, in the space below give 2 good reasons why you selected the organelle for Ranking 1.

(2)

11. Write the complete **balanced** equation for photosynthesis below:

(2)

12. Below is a very simplified version of a phospholipid bi-layer from a eukaryotic cell.



a) State the primary function of the membrane in living things.

(1)

b) The bi-layer is mainly made up of molecules called phospholipids. **Describe** and **explain** the arrangement of these phospholipids in the cell membrane.

(2)

c) Draw an **integral** protein AND a **glycolipid** in the diagram above (label each).

(2)

d) Explain a possible role or function that an **integral** type protein may have.

(1)

Part C – Extended Response

Write your answer on the lined answer sheet provided (next page). You should spend about 12-15 minutes on this section, about 3-5 minutes planning and 9-10 minutes writing. An 'A' level performance will show a clear, well-expressed answer that is well organised, relevant to the question, and demonstrates a deep and broad level of understanding.

You must have at least 8 well stated points for full marks.

NOTE: Write a separate paragraph for each dot point in the question.

1. Energy is made available to the cell in a useful form as ATP through the process of respiration.

   - **Explain** why plant cells must do photosynthesis *and* respiration to in order to make useful energy available to the cell.
   - **Discuss** the key differences between aerobic and anaerobic respiration for cellular function. **Include** a discussion the comparison and reasons for differing ATP production between the two.

Numeric marking breakdown:

/8 marks = content; 1 mark for a well stated point

Write up your rough plan outline/dot points here before you write your final answer:

Extended Response Answer Sheet

Cells & Life
Formative Test 2023 – Answers

Multiple Choice

1. L	2. M	3. M	4. M	5. K	6. J
7. J	8. K	9. J	10. K		

Short Answer

1.
The cell theory states that cells can only come from pre-existing cells, which contracts cells spontaneously appearing from non-living materials.

The cell theory also states that cells pass on genetic material – this would not be possible if cells appeared from non-cell based materials.

2.

Chloroplast:

A. Describe the double membrane; the inner membranes such as the thylakoid membranes and granum; stroma;

B. Many membranes packed together greatly increase the surface area within the organelle; this allows much more chemical reactions to do with photosynthesis to occur thus increasing efficiency.

Mitochondria:

A. Describe the double membrane; infolded membrane forming cristae; the matrix
B. Many membranes packed together and folded into cristae greatly increase the surface area within the organelle; this allows much more chemical reactions to do with respiration to occur thus increasing efficiency.

3.
Any two of the following – point out how it contradicts 7 characteristics of life

- They cannot reproduce on their own
- They cannot grow
- They cannot undergo homeostasis
- They do not do metabolism (energy use/produce waste)

4.
The reason for the different amount of DNA between G1 and G2 is because the DNA has been synthesised (replicated) in the S phase, which doubles the DNA content.

The importance of having double the amount of DNA in G2 is that the cell is then prepared for mitosis (cell division), for which it will have enough DNA to give a full set to each new daughter cell.

5.

a) 

b) from right to left

c) hypertonic solution

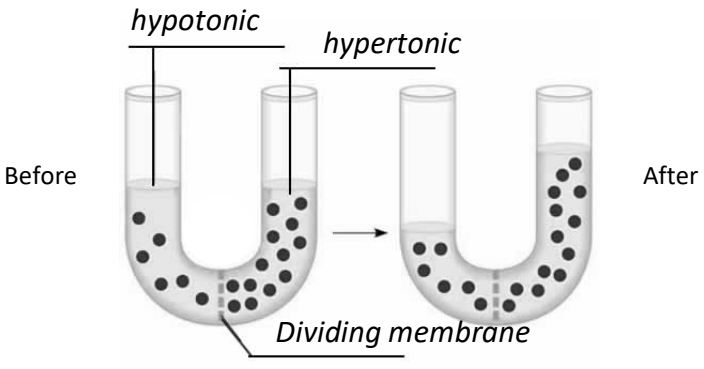
d) it would shrink and become flaccid

e) either increase the salt concentration outside the cell or decrease it inside the cell.

6. check your own diagrams for correct labels.

7.
Organism 1 would be much more efficient. The reason for this is that, due to the multicellular nature of organism 1, it has greatly increased surface area for the same amount of volume. Since this is the case nutrients and other materials will diffuse much more quickly into the centre of the organism. More surface area allows for more efficiency in diffusion.

8.
a)



b) because water have moved by osmosis to the right hand side through the membrane to where there was less water and more solute. As it moves and dilutes the solute on the right the volume of water increases.

c) yes – it only allows water through and not the solute molecules.

9.
a) it has a highly folded membrane; this increases surface area which then allows it to be more efficient in synthesising ATP

b) sketch an integral protein that is 'pumping' a molecule against a concentration gradient; include the ATP molecule with three phosphates – and one breaking off to release energy in order to make the pump work

c) ATP molecules both store and release useful energy in the cell; storage is done by respiration adding a phosphate group onto ADP which allows it to carry this energy to where the cells needs; it is release when the phosphate breaks off in order to do some work in the cell; this ADP returns to the mitochondria to be charged back up to ATP and the cycle continues.

10.
Open – as long as you gave good justifications.

11.

Photosynthesis:

$$6H_2O + 6CO_2 \xrightarrow{\text{light}} C_6H_{12}O_6 + 6O_2$$

12.
a) to separate the internal environment of the cell from external environment; to control the right conditions inside the cell.

b) They arrange themselves together in a double layer; one end of each phospholipid is hydrophobic (water repelling) and these are all oriented to the inner region of the membrane (away from the water in/out of the cell). The other end of the molecules is hydrophilic (water loving) and these all face outward where the water is. This forms a layer that is hydrophobic on the inside and water loving on the outside on both sides.

c)
Integral – protein must span the entire bi-layer
glycolipid – this must be on the surface - a glycogen molecule attached to a lipid molecule

d) Integral protein may be a channel protein that helps some substances to diffuse through the membrane (such as hydrophilic molecules); it may be a carrier proteins that also helps substances diffuse through by changing shape to assist exit or entrance from the cell.

Extended Response

Your answer must be written in paragraph form using full sentences. No need for introductions.

Here are some points you could have included in your answer.

First Dot Point

- Plant cells must do both because they must first make their 'food' molecules (sugar) as autotrophs, and then convert these energy rich food molecules into a useful form of energy via respiration. If there was only photosynthesis they would not be able to make use of the energy in the sugar.
- The product of photosynthesis in plants becomes the reactant needed in respiration.

Second Dot Point

- Compare them based on:
    - Need for oxygen to be present
    - Amount of energy that is produced (in the form of ATP) for cell use
    - The different alternate waste products produced and possible effects on cells
- Comparison of different amounts of ATP production
    - This is due to the sugar molecule being almost totally broken down (aerobic) which release a lot of energy from the sugar bonds to make more ATP; OR only slightly broken down (anaerobic), and so not releasing much from the energy in the sugar bonds to create ATP.