



OFFICE OF TASMANIAN
ASSESSMENT, STANDARDS
& CERTIFICATION

Tasmanian Certificate of Education
External Assessment 2017

PLACE YOUR CANDIDATE
LABEL HERE

BIOLOGY

(BIO315116)

PART 1

Time: 36 minutes

| | |
|--------------|-------------------|
| Pages: | 8 |
| Questions: | 4 |
| Attachments: | Information Sheet |

Candidate Instructions

1. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criteria being assessed.
2. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.
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4. This examination is 3 hours in length. It is recommended that you spend approximately 36 minutes in total answering the questions in this booklet.
5. The 2017 External Examination Information Sheet for Biology can be used throughout the examination.
6. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

Criterion 2 Develop, interpret and evaluate biological experiments.

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|----------------|-----|
| Section Total: | /35 |
|----------------|-----|

Question 1

(a) Four possible hypotheses are stated below. For each tick the Yes/No box to indicate whether they are a valid hypothesis or not. If not state **ONE** reason why not. (4 marks)

(i) Grass grows faster in the springtime.

Valid hypothesis: Yes No Reason if not:

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(ii) Snake venom once injected inhibits respiration, because it inhibits key enzymes and blocks vital nerve functions.

Valid hypothesis: Yes No Reason if not:

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(iii) The high temperatures associated with a bush fire increase the germination rate of Blackwood seeds.

Valid hypothesis: Yes No Reason if not:

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(iv) If the earth had no moon, all life on earth would die.

Valid hypothesis: Yes No Reason if not:

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Question 1 continues

Question 1 (continued)

(b) Vitamin C is believed to prevent colds. To test this, 10 000 volunteers were divided into four equal groups randomly. Each person received a dose every evening for one year. The results were as follows:

| Group | Contents of dose | Percentage who developed colds |
|-------|------------------------------|--------------------------------|
| 1 | Sugar | 20 |
| 2 | Sugar + 1 gram of Vitamin C | 19 |
| 3 | Sugar + 3 grams of Vitamin C | 21 |
| 4 | Sugar + 9 grams of Vitamin C | 10 |

(i) State which group (1, 2, 3 or 4) is the control group. Justify your answer. (2 marks)

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(ii) Briefly explain **TWO** strengths of this experiment. (2 marks)

Strength 1:

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Strength 2:

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(iii) What do these results suggest about the level of vitamin C needed to be effective against colds? (1 mark)

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Question 2

Yeast is a single-celled microscopic fungus that uses sucrose as a food source. An experiment was carried out by four separate groups of students to investigate cellular respiration by a particular species of yeast. Yeast cells were placed in a container and a 0.1 M (mol.L⁻¹) sucrose solution was added to groups 1, 2, 3 and 4. No sucrose was added to the control group.

The container was sealed in such a way as to prevent air from entering. The percentages of oxygen and ethanol in the container were recorded over a one-hour period. The experiment was carried out at a room temperature of 22°C. The results for each group and the averages are shown in the following table.

| Group | Percentage of oxygen | | Percentage of ethanol | |
|------------------------------|--------------------------------|------------------------------|--------------------------------|------------------------------|
| | At the start of the experiment | At the end of the experiment | At the start of the experiment | At the end of the experiment |
| Control | 21 | 21 | 0 | 0 |
| 1 | 21 | 18 | 0 | 5 |
| 2 | 8 | 17 | 0 | 4 |
| 3 | 22 | 19 | 0 | 3 |
| 4 | 21 | 18 | 0 | 4 |
| Average of groups 1, 2, 3, 4 | 18 | 18 | 0 | 4 |

- (a) Name the independent and dependent variables and link them to form a hypothesis that is testable by the experiment described above. (4 marks)

Independent variable:

Dependent variable:

Hypothesis:

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- (b) Name **FOUR** experimental variables that are controlled by this experimental setup (either mentioned or implied) (2 marks)

1.

2.

3.

4.

Question 2 continues

Question 2 (continued)

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- (c) One of the group measurements appears quite anomalous (unexpected). Identify the group and state if you think it is within the normal expected range of variation or a measurement recording error. Justify your conclusion. (2 marks)

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- (d) What conclusions can be validly drawn from the results? Justify your answer using the data in the table. (3 marks)

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Question 3

A student noticed that tomato plants will bend towards the light.

- (a) Design an experiment to investigate if the colour of light affects the amount of stem bending (phototropism) in tomato plants. In your experiment include your procedure and how you would collect and present your results. No hypothesis is required. (8 marks)

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- (b) Given that the results show different colours affect the amount of stem bending, suggest how this experiment could be followed-up. (2 marks)

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Question 4

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Recently, the medical journal *The Lancet* published a study on pain relief for patients with knee and hip osteoarthritis. One of the findings was that paracetamol was only slightly better than a placebo in reducing pain.

The study analysed data from 74 randomised control trials (RCTs), each with at least 100 patients per group, published between 1980 and 2015. In total, 58 556 patients and 22 treatments were included in the analysis. Various doses of seven different non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol were included in the treatment groups, along with placebos.

Using sophisticated statistical analysis they found that the NSAIDs were 95-100% likely to reduce pain, whilst the highest-ranked paracetamol dose (3g per day) was linked to only a 21% chance of helping pain. Doses less than 2g had only a 4% chance of helping reduce pain.

Discuss the **challenges** involved in a study of this nature. In your answer use the above information to highlight and justify the relative **strengths** and **weaknesses** of this study.
(5 marks)

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BIOLOGY

(BIO315116)

PART 2

Time: 36 minutes

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|--------------|-------------------|
| Pages: | 12 |
| Questions: | 4 |
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On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

Criterion 5 Describe and apply concepts and processes of the chemical basis of life.

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| Section Total: | /36 |
|----------------|-----|

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Question 5

The nucleotide sequence below represents a section in the middle of a gene sequence on one strand of DNA.

G A T G T T T T C G A T C T A A C T

- (a) Write down the nucleotide sequence of the second or complementary strand of this DNA sequence. (2 marks)

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- (b) Write down the nucleotide sequence of the messenger RNA that would be specified by the **ORIGINAL** DNA sequence at the start of the question. (1 mark)

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- (c) Explain the role of messenger RNA. (2 marks)

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- (d) State the number of amino acids specified by the nucleotide sequence above. (1 mark)

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- (e) Outline **TWO** things that could change this amino acid sequence. Explain the cause and effect of these changes. (3 marks)

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Question 6

- (a) You are asked to explain to a group of grade 10 students how a commercial greenhouse grower can potentially optimise the rate of photosynthesis in their greenhouse plants.

Identify **FOUR** different factors that influence the rate of photosynthesis.

For **TWO** of these factors, explain how they could be optimised to promote the most efficient rate of photosynthesis and growth in the greenhouse. (4 marks)

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- (b) Plants also carry out the process of aerobic respiration. This is often said to be the reverse of photosynthesis. Although this is not completely accurate, on a simpler level it could be said to be true.

In the table below, state **THREE** ways in which these processes could be said to be the reverse of one another. (4 marks)

| Aerobic Respiration | Photosynthesis |
|---------------------|----------------|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |

State **ONE** way in which they cannot be considered the reverse of each other.

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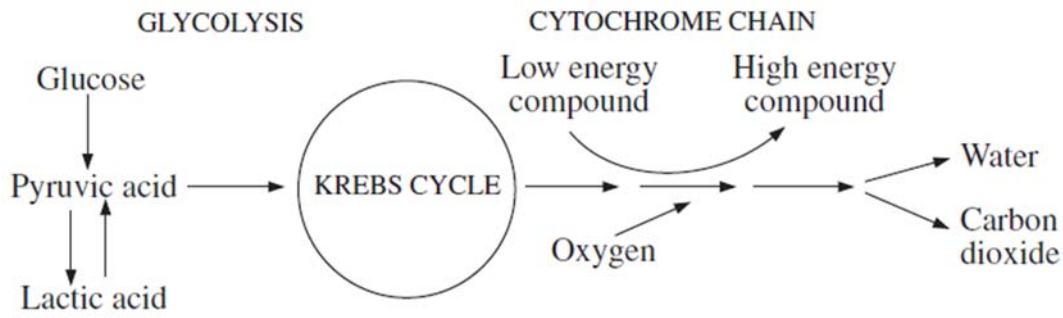
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Question 6 continues

Question 6 (continued)

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(c) The diagram below is an overview of a sequence of metabolic pathways in living cells.



(i) State the biological name of this (overall) process. (1 mark)

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(ii) Identify the high energy compound shown in the diagram and give **TWO** properties that make it ideal for its role. (2 marks)

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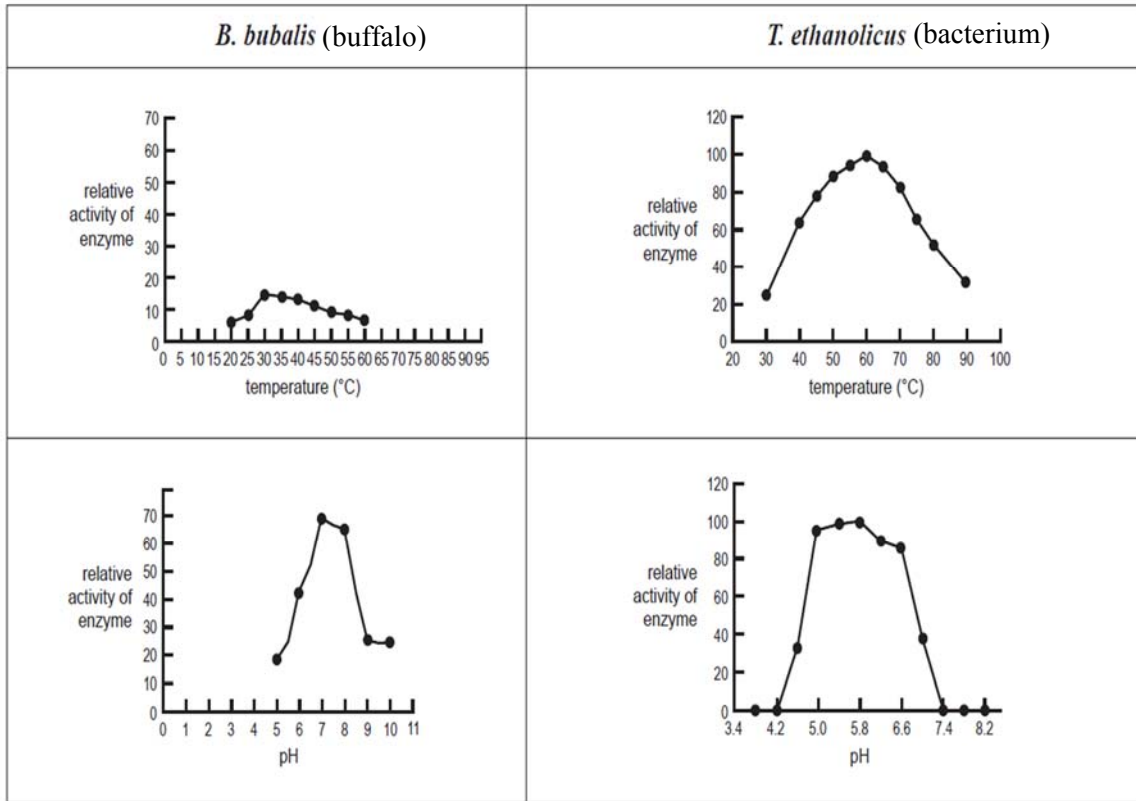
(iii) Is oxygen always needed to produce this high energy compound in all cells? Explain. (2 marks)

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Question 7

- (a) The enzyme lactate dehydrogenase is found in a wide variety of organisms. It catalyses the conversion of both pyruvate to lactate and lactate to pyruvate.

The River Buffalo (*Bubalus bubalis*) is a domestic animal common in Pakistan. The bacterium (*Thermoanaerobacter ethanolicus*) lives in geothermal (hot) springs. Scientists studying the enzyme lactate dehydrogenase from these two organisms in varying temperatures and pH, produced the following graphs.



- (i) From the graphs above, suggest the optimum temperature for this enzyme in the River Buffalo and the bacterium. (1 mark)

River Buffalo:..... Bacterium:.....

- (ii) Identify **ONE** key difference in the relative activity of the enzymes with varying pH conditions for the two species. Explain why this is to be expected. (2 marks)

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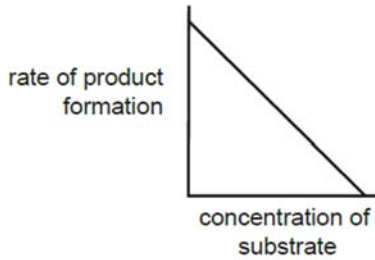
Question 7 continues

Question 7 (continued)

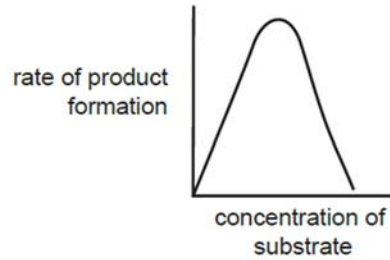
- (b) Consider an enzyme-facilitated reaction in which the concentration of the enzyme is constant.

State which of the following graphs shows the effect of increasing substrate concentration on the rate of product formation. (2 marks)

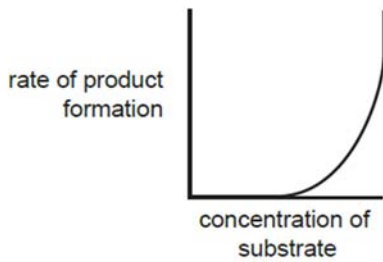
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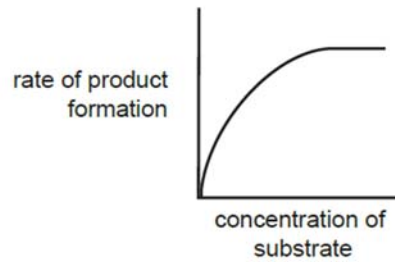
K.



L.



M.



Correct graph:

Explanation:.....

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- (c) Briefly outline how the induced fit model explains how enzymes can interact to both bind and release specific substrates/products to produce rapid catalysis. (3 marks)

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Question 8

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Locusts (see picture) are insects that cause extensive crop damage when they swarm in large numbers.



Professor Stephen Simpson and his team from the University of Sydney have discovered that the locusts keep eating the crops until they have consumed enough protein. This has given scientists a better understanding of human nutrition and how it relates to obesity.

They suggest humans might be doing the same, fuelling the obesity epidemic.

- (a) Discuss why proteins in the diet are so important. In your answer, include an explanation of how such an appetite response would meet our nutritional needs more efficiently. (4 marks)

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- (b) Assuming this phenomena applies to humans, discuss the implications about what makes up a healthy diet and how we can avoid obesity. (2 marks)

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BIOLOGY

(BIO315116)

PART 3

Time: 36 minutes

| | |
|--------------|-------------------|
| Pages: | 12 |
| Questions: | 4 |
| Attachments: | Information Sheet |

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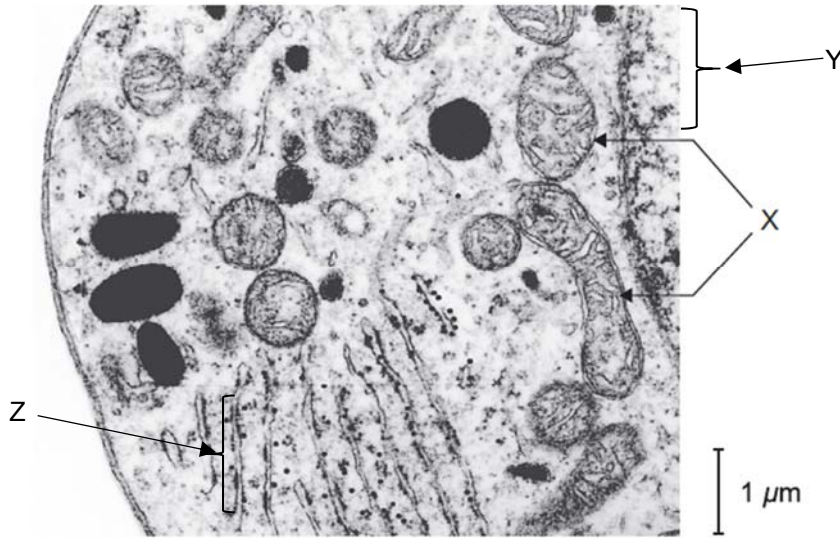
On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

Criterion 6 Describe and apply concepts and processes involving cells.

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| Section Total: | /36 |
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Question 9

(a) The electro-micrograph below shows a portion of a cell.



(i) Identify the organelles indicated by the arrows Y and Z. (1 mark)

Y:

Z:

(ii) Identify **TWO** features that indicate this is an animal cell. (1 mark)

1.

2.

(iii) Given the large number of organelles X and Z, what does this suggest about the function of the cell? Explain. (3 marks)

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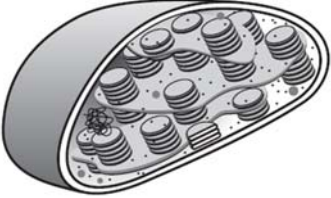

Question 9 continues

Question 9 (continued)

(b) Complete the table below by:

- stating the name of each cell component shown
- describing the main function of each component
- indicating if the component is found in plant and/or animal cells (write **yes** or **no** in the appropriate boxes). (6 marks)

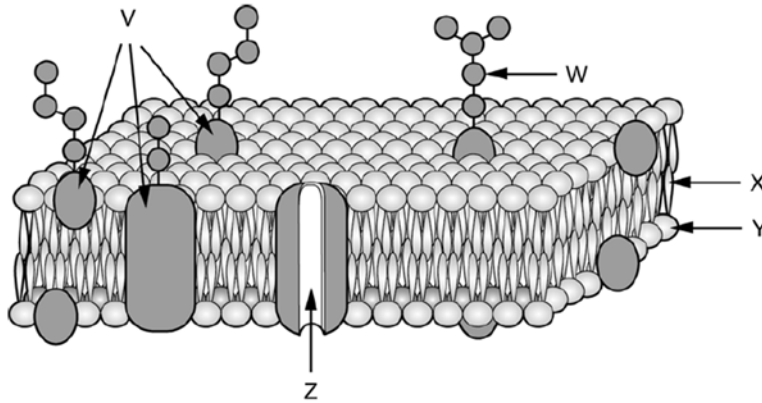
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| Cell component | Name | Function | Present in | |
|---|------|----------|--------------|-------------|
| | | | Animal cells | Plant cells |
|  | | | | |
|  | | | | |
|  | | | | |

Question 10

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(a) Refer to the diagram below of a model of the cell membrane.



(i) State the main function of structure Z and outline the properties that make it well suited to this function. (2 marks)

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(ii) Cells cannot rely on passive diffusion alone to regulate the movement of substances in and out. Explain why this is not possible and outline **THREE** ways **other than** passive diffusion by which substances can be moved across a cell membrane, referring to the above diagram where appropriate. (4 marks)

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Question 10 continues

Question 10 (continued)

- (b) Discuss the truth or otherwise of the following statement and how well you think it applies in practice.

'The more active a cell is, the smaller it tends to be, limited only by the need to fit in the essential machinery to carry out the cell's functions.' (3 marks)

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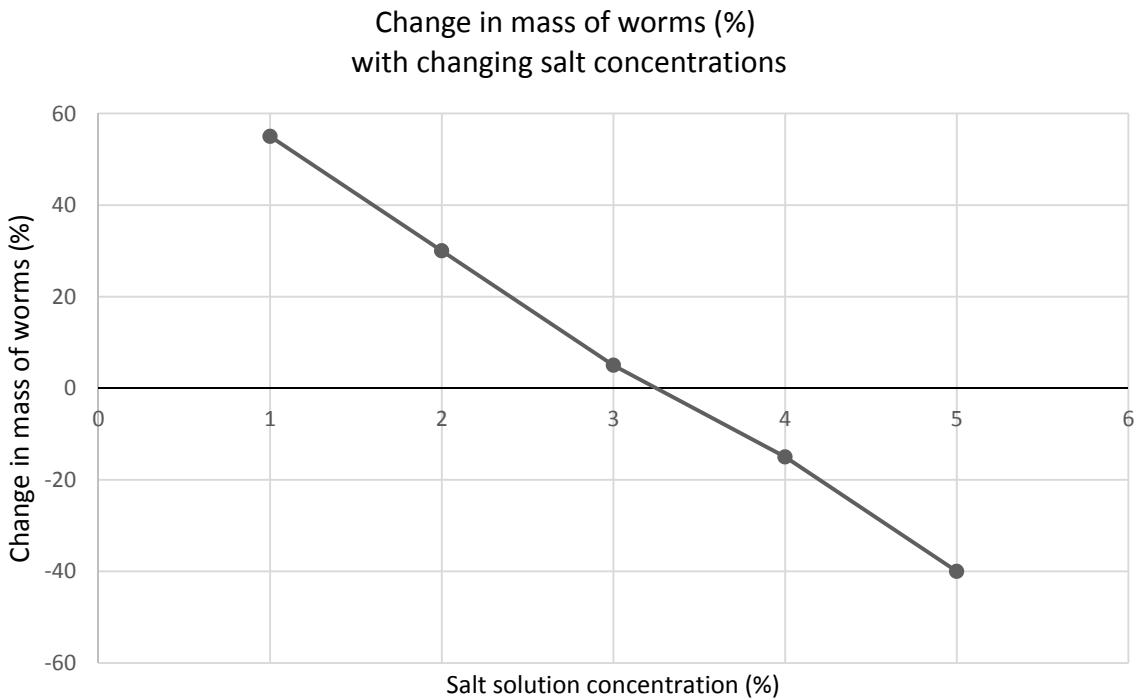
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Question 11

A scientist collected 50 marine worms, which normally live in seawater. Groups of 10 worms were weighed and each group placed in a different salt concentration. After 12 hours, each group was reweighed and the change in mass calculated as a percentage. The results are shown in the graph below.



- (a) What is happening to the worms when they are placed in a 1% salt solution? Explain the process that is causing this. (3 marks)

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- (b) State the normal internal concentration of these worms. Justify your answer. (2 marks)

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Question 11 continues

Question 11 (continued)

**For
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- (c) To what extent can these worms regulate their internal osmotic concentration?
Explain your answer using information from the graph. (3 marks)

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- (d) What is the most likely reason that the scientist did not test the worms below 1% salt solution? Explain. (2 marks)

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/10

Question 12

**For
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Mitosis and meiosis both produce new cells.

(a) Which of the following alternatives, J, K, L, or M, most correctly identifies the process of: (2 marks)

(i) Mitosis?

(ii) Meiosis?

| | Number of Chromatids involved | Genotype of daughter cell |
|---|---------------------------------|--------------------------------|
| J | One for each of its chromosomes | Different from the parent cell |
| K | Two for each of its chromosomes | Identical to the parent cell |
| L | Two for each of its chromosomes | Different from the parent cell |
| M | One for each of its chromosomes | Identical to the parent cell |

(b) Which one of mitosis and meiosis produces the most variation in the daughter cells? Outline **TWO** processes that contribute to this. (3 marks)

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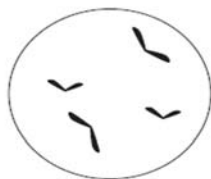
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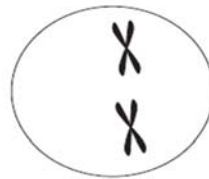
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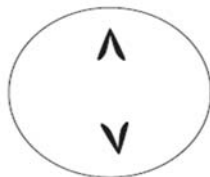
(c) Which **ONE** of the following diagrams represents the chromosomes contained in a cell that has a diploid number of 4 and has just completed **mitotic** division? Circle the appropriate letter. (1 mark)



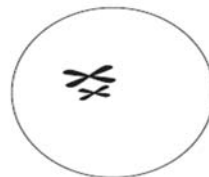
J



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PART 4

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Criterion 7 Describe and apply concepts and processes within organisms.

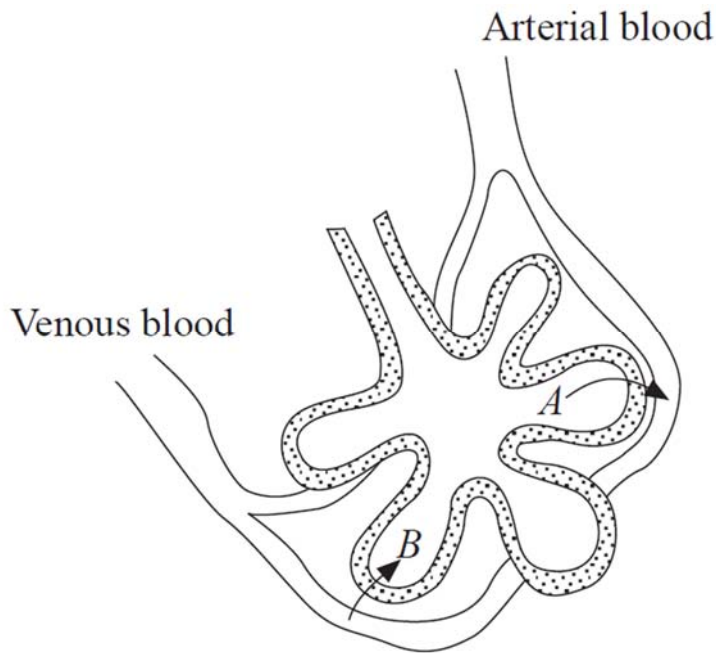
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Question 13

(a) The diagram below shows a structure in mammals in which gaseous exchange occurs.

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(i) Identify substances A and B. (1 mark)

A:

B:

(ii) Explain **THREE** ways in which the structural arrangement shown above helps to maximise gas exchange. (3 marks)

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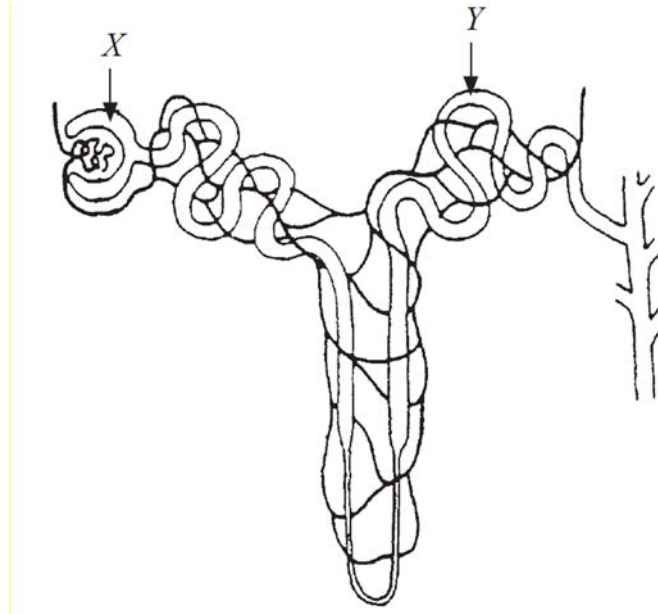
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Question 13 continues

Question 13 (continued)

**For
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(b) The diagram below represents a nephron which is the basic filtering unit of the kidney.



(i) Name the process by which the fluid is produced at X. (1 mark)

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(ii) State how the fluid at Y differs from that at X. How is this achieved? (3 marks)

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Question 13 continues

Question 13 (continued)

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- (iii) Explain the role of the kidney in the homeostatic control of water levels (osmotic concentration) of the blood and how it fits the negative feedback model. Include the key steps in the model and relate this to **EITHER** conditions of excess water intake/reduced loss **OR** reduced intake/excess water loss. (5 marks)

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Question 14

**For
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(a) It can be said that all the preliminary processes in digestion are fundamentally about preparing the food materials for absorption.

(i) What is the main reason why this preparation is necessary prior to absorption? (1 mark)

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(ii) Describe the processes that are important in this preparation. Briefly discuss how and where they occur in the human digestive system. (3 marks)

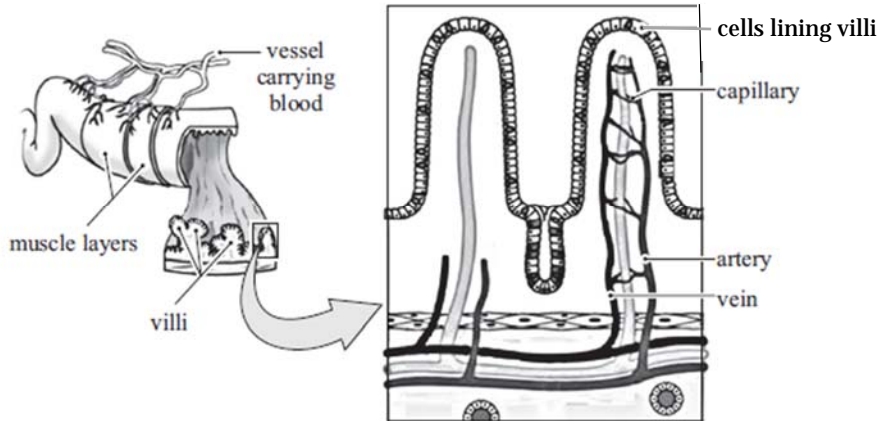
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Question 14 continues

Question 14 (continued)

(b) The diagrams below show the major structures of a section of the digestive system.

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(i) What section of the digestive system is shown in the diagrams above? (1 mark)
Give **ONE** reason for your choice. (1 mark)

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(ii) Describe, in detail, how the structures shown in the diagrams above help maximise the efficiency of digestive absorption. (6 marks)

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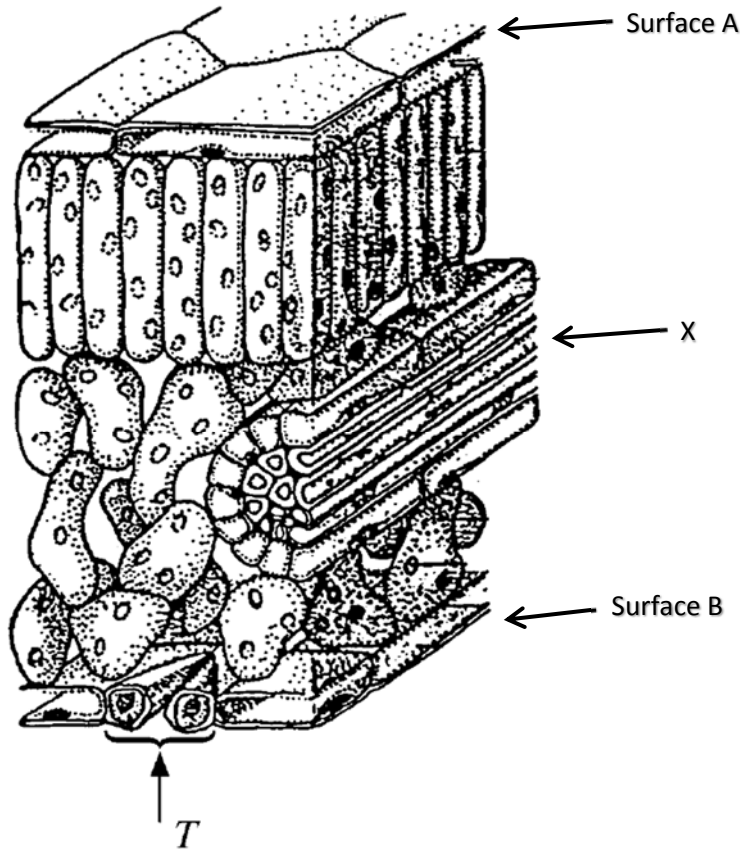
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Question 15

**For
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(a) The diagram below represents a generalised section of the leaf of a plant.



(i) State which surface (A or B) would most likely face towards the sun. Give reasons and include in your answer the differences you would expect in the epidermal layer that faces the sun compared to the one that faces away from it. (4 marks)

Surface:

Reasons:

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Question 15 continues

Question 15 (continued)

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- (ii) What substance required for photosynthesis is transported in structure X?
Also name the processes involved in its transport. (2 marks)

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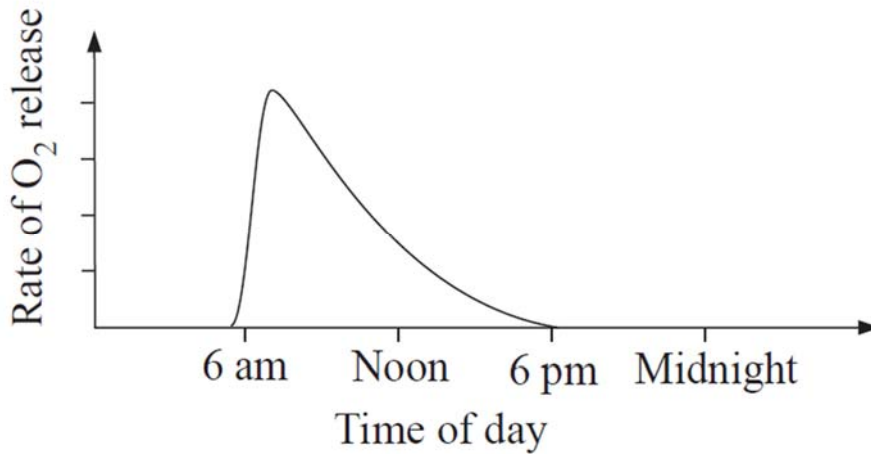
Question 15 continues

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Question 15 (continued)

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- (b) A certain plant was tested to find the rate of oxygen released from its leaves at different times during the day. The graph below shows the results.



- (i) What does the information from the graph indicate about the plant and the amount of water lost through transpiration during this particular day? Justify your answer. (4 marks)

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- (ii) State **TWO** things that can be reasonably concluded from the shape of the graph in terms of the local environmental conditions the plant is experiencing on that day. (2 marks)

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OFFICE OF TASMANIAN
ASSESSMENT, STANDARDS
& CERTIFICATION

Tasmanian Certificate of Education
External Assessment 2017

PLACE YOUR CANDIDATE
LABEL HERE

BIOLOGY

(BIO315116)

PART 5

Time: 36 minutes

| | |
|--------------|-------------------|
| Pages: | 12 |
| Questions: | 4 |
| Attachments: | Information Sheet |

Candidate Instructions

1. You **MUST** make sure that your responses to the questions in this examination paper will show your achievement in the criteria being assessed.
2. Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.
3. You should make sure you answer all parts within each question so that the criterion can be assessed.
4. This examination is 3 hours in length. It is recommended that you spend approximately 36 minutes in total answering the questions in this booklet.
5. The 2017 External Examination Information Sheet for Biology can be used throughout the examination.
6. All written responses must be in English.

On the basis of your performance in this examination, the examiners will provide results on each of the following criteria taken from the course statement:

Criterion 8 Describe and apply concepts and processes related to continuity of organisms and survival of changes.

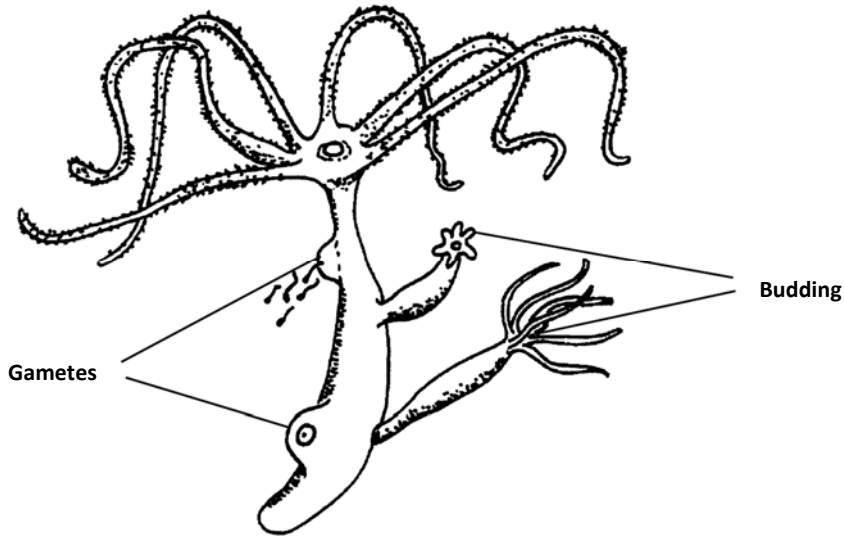
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Question 16

**For
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- (a) Simple animals, such as the Hydra shown below, can use both sexual and asexual reproduction (for example by fission, fragmentation or budding).



Explain **THREE** advantages for such organisms to be able to reproduce both sexually and asexually. (3 marks)

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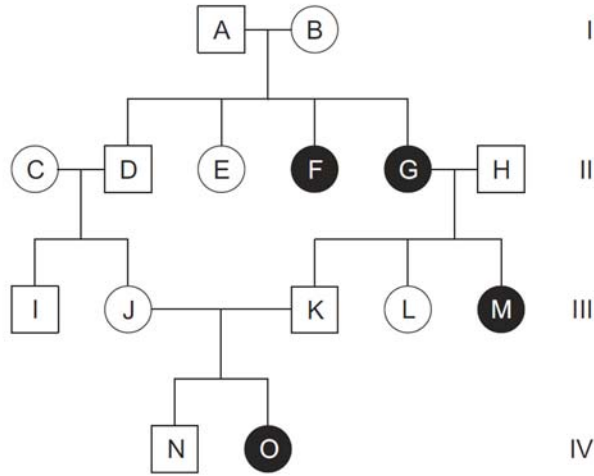
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Question 16 continues

Question 16 (continued)

- (b) The following diagram shows a pedigree for the condition of albinism in humans. People with albinism lack pigment in the hair, skin and eyes.



- (i) Give **ONE** clear piece of evidence from the pedigree above that shows this disease is not X-linked recessive (sex linked on the X chromosome), along with your reasoning. (2 marks)

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- (ii) Does this disease involve an autosomal dominant or an autosomal recessive allele? Justify your answer. (2 marks)

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Question 16 continues

Question 16 (continued)

**For
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(iii) If III – J and III – K have another child, what is the probability that they will have a child affected by albinism? Show your working. (2 marks)

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(c) The ABO blood group system is under the control of a single gene with the alleles:

- I^A : presence of protein A on red blood cells
- I^B : presence of protein B on red blood cells
- i : neither protein A or B on red blood cells

With respect to the ABO blood group locus it is possible to produce children of four different phenotypes if the parents are one of the following alternatives:

- J. type B x type B
- K. type A x type B
- L. type O x type AB
- M. type AB x type AB

State the correct alternative and give the genotypes of the parents below. (2 marks)

Correct alternative:

Parental genotypes:

Question 17

**For
Marker
Use
Only**

(a) The table below shows the classification of some Australian plants.

| Common name | Kingdom | Phylum | Class | Order | Family | Genus | Species |
|---------------------|---------|---------------|---------------|-------------|------------------|-------------------------|----------------------------|
| Grey gum | ↓ | Magnoliophyta | Magnoliopsida | Myrtales | Myrtaceae | <i>Eucalyptus</i> | <i>Eucalytus propinqua</i> |
| Wallum bottle brush | | | | ↓ | | ↓ | <i>Callistemon</i> |
| Wallum banksia | | | | Proteales | Protaceae | <i>Banksia</i> | <i>Banksia robur</i> |
| Silky oak | | | | ↓ | | ↓ | <i>Grevillea</i> |
| Grey mangrove | | | Lamiales | Verbenaceae | <i>Avicennia</i> | <i>Avicennia marina</i> | |
| Mitchell grass | | | ↓ | Liliopsida | Cyperales | Poaceae | <i>Astrebla</i> |

(i) Using information from the table above, identify the plant that is the most different from the others? Explain briefly. (1 mark)

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(ii) Explain **TWO** advantages of classification schemes like the one illustrated above. (2 marks)

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(iii) Give **TWO** reasons why the scientific community makes changes over time to the biological classification of many organisms. (2 marks)

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Question 17 continues

Question 17 (continued)

**For
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- (b) Over the past million years, Australia's climate has become much drier, leading to reduced areas of forest and woodland. Studies of mitochondrial DNA in different spider species from various woodlands show they share a 'recent' common ancestor dating back to just before the climate began to become drier.

Discuss the process of the evolution of today's divergent woodland spider species. In your explanation include the concepts of gene flow and genetic drift and how they apply in this case. (5 marks)

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Question 18

**For
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- (a) Most people ingest many potentially disease-causing bacteria on a daily basis, yet they mostly don't suffer from these diseases. Outline **TWO** defences within the digestive system that prevent this happening. (2 marks)

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- (b) Swollen lymph nodes are a sign of infection in the body. State **TWO** things this tells us about the way the body is responding to infection? (2 marks)

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- (c) It is always preferable to prevent disease rather than try to cure it. One of the best ways is to limit the spread of a disease.

- (i) Using an example, explain how disruption of the life cycle of a pathogen is **ONE** of the key ways to control the spread of an infectious disease. (2 marks)

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- (ii) State **ONE** way in which a high rate of immunisation in a population can restrict the spread of a disease. (1 mark)

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Question 19

**For
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A number of your friends have just been sick with influenza (the 'flu'), and now you seem to have become infected too.

- (a) Describe how B-cells and T-cells work together in response to such an infection. (4 marks)

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- (b) You have completely recovered from this bout of the 'flu'. You are again exposed to the same virus but do not become sick. However, this does not guarantee that you won't catch the 'flu' again next year. Explain the reason for this. (2 marks)

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- (c) Could your infection have been prevented by using antibiotics? Give **ONE** reason for your answer. (1 mark)

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