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90927



909270



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## Level 1 Biology, 2016

### 90927 Demonstrate understanding of biological ideas relating to micro-organisms

9.30 a.m. Wednesday 23 November 2016

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of biological ideas relating to micro-organisms.	Demonstrate in-depth understanding of biological ideas relating to micro-organisms.	Demonstrate comprehensive understanding of biological ideas relating to micro-organisms.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

Merit

TOTAL

15

ASSESSOR'S USE ONLY

## QUESTION ONE: PRESERVING FOOD

Fresh food can be spoiled and go off due to the presence of micro-organisms. Freeze-drying is one way of preserving food so that it can be stored for a long time before use. The diagram below shows how freeze-drying is carried out.



Adapted from: <http://www.lio-licious.com/useful-info>

Discuss how the process of freeze-drying helps to preserve food.

Your answer should:

- describe the environmental factors required for micro-organisms to carry out life processes
- describe where the micro-organisms that spoil food come from *saprotrophic*
- explain how micro-organisms carry out life processes that cause food to spoil or go off *toxic waste*
- explain what the freeze-drying process does that helps to preserve food.

*Micro-organisms require warmth, oxygen and water to prevent  
in order to carry out life processes. Micro-organisms that spoil  
food cause decomposition and decay that results in food  
spoilage. ~~they assist in digestion~~ Bacteria feed  $\rightarrow$  extra  
cellular digestion, the ~~secrete~~ secrete enzymes out of the  
bacterium onto the food particle where the enzymes then ~~break~~  
 $\downarrow$  digest it down into smaller food molecules, the bacterium then absorbs*

their back into ~~the tree~~ in (including food). Fungi also feed by extra cellular digestion, they secrete enzymes out of their hyphae which ~~breaks~~<sup>digests</sup> the food particles into smaller particles that are then absorbed by the fungi. This can cause food spoilage as the bacteria and fungi are eating the food particles for them to get energy. Large populations of micro-organisms in general can result in food spoilage as they can be toxic to humans in large numbers. Micro-organisms can also secrete toxic waste onto the food while they ~~inhibit~~ inhibit it which leads to food spoilage. The freeze drying process helps to preserve food as it removes the warmth, moisture and oxygen from the food.

The foods temperature is lowered when it is flash frozen, this stops the enzymes in micro-organisms from being able to move as quickly (less kinetic energy) so they won't be able to carry out life processes. The moisture is then drawn off by evaporating the ice, without moisture the enzymes will not be activated so they will not be able to carry out any life processes.

It is then sealed in moisture and oxygen proof packaging, without oxygen the micro-organisms can not do aerobic respiration ( $\text{Glucose} + \text{Oxygen} \rightarrow \text{Carbon dioxide} + \text{water}$  ~~+ energy~~) so they will have no energy to do life processes. The freeze drying process removes all conditions and factors required for micro-organisms to spoil food through its life processes.

## QUESTION TWO: FUNGI AS PLANT PATHOGENS

Loss of crops or food spoilage due to fungal diseases caused by fungal pathogens can have a large impact on human food supplies.



(a)

(b)



(c)

(d)

Some fungal pathogens include (a) green mould on grapefruit, (b) powdery mildew on a zinnia, (c) stem rust on barley, and (d) grey rot on grapes.

Source: [www.boundless.com/biology/textbooks/boundless-biology-textbook/fungi-24/fungal-parasites-and-pathogens-152/fungi-as-plant-animal-and-human-pathogens-600-11819](http://www.boundless.com/biology/textbooks/boundless-biology-textbook/fungi-24/fungal-parasites-and-pathogens-152/fungi-as-plant-animal-and-human-pathogens-600-11819)

*extra* *respiration* *growing* *spore* *reproduction*  
Discuss how fungi feed, grow, and reproduce as pathogens on plants, and how damage to crops or food spoilage from fungal pathogens can be minimised.

Your answer should:

- define the term pathogen
- explain how fungi feed, grow, and reproduce on plants
- explain how environmental factors allow fungi to grow quickly on plants
- explain how crop damage or food spoilage from fungal growth could be minimised
- compare the links between the methods used to control fungi and the expected changes to fungal growth and reproduction.

A pathogen is a disease causing micro-organism. Fungi feed by extracellular digestion, the fungi secrete enzymes onto a food particle (plant) which then digests it into smaller particles so the fungi can then absorb it. Fungi do respiration in order to grow, it can do aerobic respiration ( $\text{glucose} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water} (+\text{energy})$ ) or anaerobic respiration ( $\text{glucose} \rightarrow \text{ethanol} + \text{carbon dioxide} (+\text{some energy})$ ), both produce energy for the fungi to then use in life processes for growth and repair. ~~The~~ Fungi reproduce by the sporangium, attached to the hyphae, producing spores that ~~go into the air~~ for reproduction. Warmth, moisture and oxygen allow fungi to grow quickly on plants. Warmth gives the enzymes responsible for life processes such as growth, ~~kinetic~~ energy, for biological reactions to occur. Moisture activates the enzymes and oxygen is needed in the respiration process. If oxygen is present it means the fungi ~~can~~ can do aerobic respiration instead of anaerobic which gives the fungi more energy for life processes, since it has more energy, the fungi will be able to grow quickly and spread. Crop damage and food spoilage from fungal growth can be minimised by a ~~as~~ spray that kills off fungi. This could harm the fungi and stop them from reproducing and growing. Food spoilage from fungal growth could also be minimised by ~~putting~~ covering the food with something that prevents oxygen from entering. This will cause fungal reproduction and growth to be very minimal as oxygen is needed in ~~a~~ aerobic respiration to get <sup>the most</sup> energy from glucose for growth and repair.

M5

### QUESTION THREE: NUTRIENT CYCLING

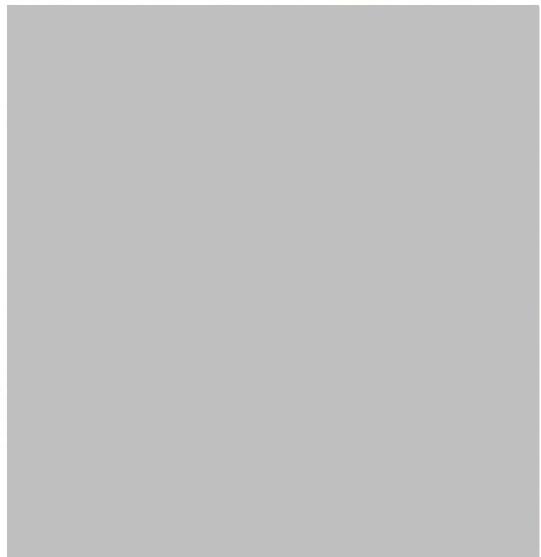
Nitrogen and carbon are two essential nutrients cycled by micro-organisms.

#### The Nitrogen Cycle



Sources: [https://en.wikipedia.org/wiki/Nitrogen\\_fixation](https://en.wikipedia.org/wiki/Nitrogen_fixation)

#### The Carbon Cycle



[www.thinklink.com/scene/700750299547041793](http://www.thinklink.com/scene/700750299547041793)

Compare and contrast the role of micro-organisms in nutrient cycling in the nitrogen and carbon cycles.

Your answer should:

- describe the role of micro-organisms in nutrient cycling in the nitrogen cycle
- describe the role of micro-organisms in nutrient cycling in the carbon cycle
- explain why nutrient cycling is important to the ecosystem
- discuss the similarities and the differences in the role of micro-organisms in nutrient cycling for the nitrogen and the carbon cycles.

Nitrogen-fixing bacteria in the nitrogen cycle turn the nitrogen found in soil and legume root nodules into nitrates which the plant then absorbs for life processes. Nitrifying bacteria (decomposers) then release nitrates from dead animals that have eaten plants that contain nitrates. Denitrifying bacteria then turns the nitrates in the soil from released from decomposers into nitrogen which then goes into the carbon cycle, back into the atmosphere. Animals eat plants that have photosynthesised using carbon dioxide to make sugars (glucose). When animals eat this the CO<sub>2</sub> is released inside of them. The CO<sub>2</sub> is then either put back into the atmosphere from animal respiration (glucose + oxygen → carbon dioxide + water)

or once it has died, decomposing micro-organisms such as saprotrophic bacteria cause decomposition and dead decay on the dead organism, releasing the  $\text{CO}_2$ . ~~this over the if it does no~~ or being compressed and turned into fossil fuels. Plant respiration also released  $\text{CO}_2$  (glucose + oxygen  $\rightarrow$  carbon dioxide + water). ~~(glucose)~~

Nutrient cycling is important to the ecosystem as it keeps necessary nutrients such as nitrogen and carbon in the atmosphere which are required for life processes ~~in~~ in the nitrogen cycle and organisms. Similarities between ~~nutrient cycling and~~ the carbon cycle are that both involve decomposers that release nitrates or carbon. The difference is that carbon does not have to be changed into another form like nitrogen has to be changed into nitrates. This is because organisms can use it in its original form in their life processes.



# Annotated Exemplar Template

## Merit exemplar 2016

Subject:		Biology	Standard:	90927	Total score:	15
Q	Grade score	Annotation				
1	M6	<p>This is M6 because it demonstrates in-depth understanding of biological ideas relating to micro-organisms. It does this by providing evidence of at least two explanations of how micro-organisms carry out life processes that cause food to spoil or how the freeze-drying process helps to preserve food. For example, this response explains how and why extra-cellular digestion occurs and how reducing the temperature and moisture levels in the freeze-drying process affects micro-organism life processes. In order to be E7 the response would need to make multiple links between relevant ideas.</p>				
2	M5	<p>This is M5 because it demonstrates in-depth understanding of biological ideas relating to micro-organisms. It does this by providing evidence of at least one explanation of how micro-organisms carry out life processes that cause food to spoil or how the freeze-drying process helps to preserve food. For example, this response explains the effect of the presence of oxygen on respiration and growth of fungi. In order to be M6 the response would need to provide evidence of at least two examples of explanation, rather than just one.</p>				
3	A4	<p>This is A4 because it demonstrates understanding of biological ideas relating to micro-organisms. It does this by providing evidence of at least 4 relevant biological ideas in relation to the role of micro-organisms in nutrient cycling in the carbon and nitrogen cycles. For example, it describes the role of nitrogen-fixing bacteria, the role of micro-organisms as decomposers, the importance of nutrient cycling to the ecosystem and describes a difference between the carbon and the nitrogen cycle. In order to gain M5, the response would need to provide evidence of in-depth understanding by explaining a relevant biological idea.</p>				