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# Level 1 Biology, 2017

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

9.30 a.m. Thursday 16 November 2017
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 16

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## QUESTION ONE: FOOD PRODUCTION AND STORAGE – YOGHURT

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One way to preserve milk is by fermentation. Yoghurt is made by fermenting milk, using bacteria such as *Lactobacillus* that produce lactic acid. The increase in acidity changes the flavour and texture of the milk, making yoghurt.

Lucas and Sarah each followed the steps below to make yoghurt.

**Yoghurt making instructions:**

- Heat 200 mL of milk to 80°C.
- Cool the milk to 30°C.
- Add 50 mL of yoghurt that contains *Lactobacillus* bacteria and stir gently.
- Leave in a warm place for 8 hours.

After eight hours they checked the yoghurt, and noticed that it looked thick and white, just like store-bought yoghurt. Sarah then put hers in an airtight container in the fridge. Lucas left his on the bench.

When they came back two days later, Lucas noticed that there were fungi growing on his yoghurt, and that Sarah's still looked fresh and did not have fungi growing on it.



Lucas's yoghurt with fungal growth.

www.ehow.co.uk/info-tip_7984683_dangerous-eat-moldy-yogurt.html

Sarah's yoghurt.

Discuss how the life processes of microbes allow bacteria to be used to make yoghurt, and how the life processes of microbes determine how we need to store food to keep it fresh.

In your answer:

- describe the process of fermentation that occurs in bacteria such as *Lactobacillus*
- describe the environmental factors required for the growth of the bacteria (*Lactobacillus*) in the yoghurt
- explain how the life processes of bacteria allow them to be used in making foods like yoghurt
- discuss the importance of storing the finished yoghurt in an airtight container in the fridge to keep it fresh.

Lucas and Sarah used Lactobacillus bacteria to make their yoghurt. It seems like Lactobacillus bacteria respirate anerobically as in the description, it says that Lactobacillus bacteria produces lactic acid. I know that it's anerobic because in the equation it says, 'sugar → latic acid + water + some





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energy.' After Lucas and Sarah heated the milk to 80°c and cooled it down to 30°c, they added to Lactobacillus bacteria. They had to add the bacteria in at this point as the milk is setting at the right temperature. For the bacteria to grow and reproduce effectively, the environment that they are in have to consist of warmth, moisture and rich in neutrents. In this case, the Lactobacillus bacteria had everything. The temperature was 30°c which is the rate that bacteria and fungi can grow rapidly. The bacteria had moisture, not just a bit but loads and it also have loads of neutrents from the milk. For the bacteria to grow, they use these environmental factors to reproduce and make energy. However, to make more offsprings, they need to make energy first. Bacteria make their energy by what is called extra-cellular digestion. This is when the bacteria sends enzymes out from its cell onto the food particle (milk). The enzymes then breaks down the food particles into smaller molecules which is then absorbed back into the cell to be turned into energy. After adding the Lactobacillus bacteria into the milk and is stired gently, the yoghurt is then left in a warm place for 8 hours. This is when the bacteria can respirate, grow and reproduce. The warmth also helps the bacteria to grow, respirate and reproduce faster as they all are retried and if one process isn't there, the bacteria will not be able to reproduce. together. The life process of the bacteria helped in the making of food such as yoghurt because for yoghurt to be able to become yoghurt, they need to have what is called the lactic acid. Since Lactobacillus bacteria produces lactic acid when it respirate, it would make sense to have it in the making of yoghurt. The bacteria can respirate anerbicially which means they do not need oxygen which is why they produce lactic acid as arobic respiration does not produce lactic acid. Instead it produce carbon dioxide like this equation, 'sugar + oxygen → carbon dioxide + water + lots of energy'. The importance of storing the yoghurt in an airtight container in the fridge is to stop or at least slow down the growth and reproduction of the bacteria. By keeping it in an airtight container * M6

* See carried onto the back

## QUESTION TWO: ANTIBIOTICS, BACTERIA, AND VIRUSES

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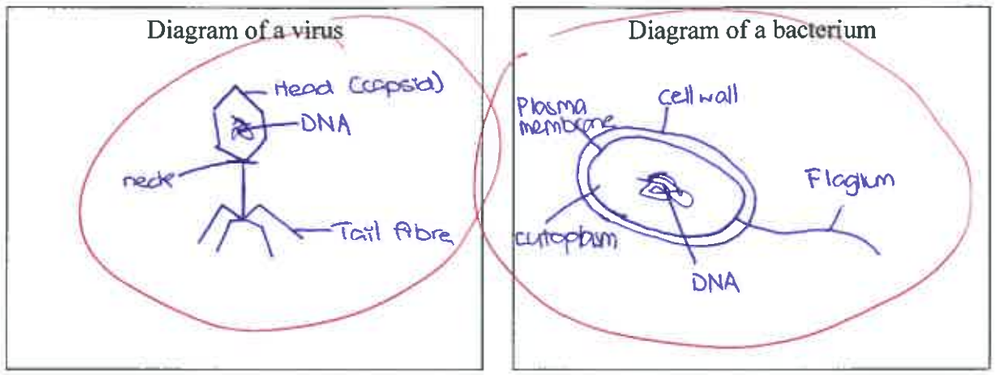
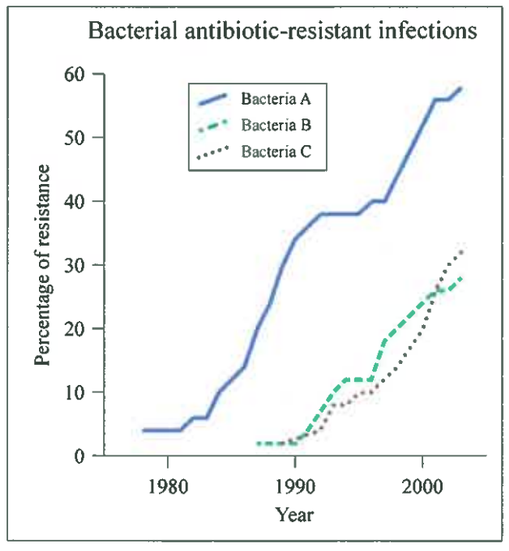
The use of antibiotics has reduced the number of deaths due to bacterial infections around the world. Antibiotics can kill bacteria, but are not effective against viruses.

(a) Draw a labelled diagram of a virus and a bacterium.




(b) In recent years, some pathogenic bacteria have become resistant to antibiotics.




www.futuretimeline.net/blog/2013/04/25-2.htm#.WDTxXaJ968o

Discuss the use of antibiotics to treat bacterial infections.

In your answer:

- describe the trend in the percentage of antibiotic resistance shown in the graph
- explain the effects of antibiotics on the life processes of bacteria
- explain why bacterial infections can be treated with antibiotics, while viral infections cannot
- discuss how antibiotic resistance in bacterial populations can develop, and how it can be reduced.





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From the graph of 'Bacterial antibiotic-resistant infections' it seems like when the antibiotic was first introduced, its effect was major for only around about 3-4 years max. After that, it seems like the bacteria began to be amuned to the antibiotic as we can see that the percentage of the resistance started to increase. It started to increase slightly but then it took off from there. From looking at the graph, we can clearly say that this antibiotic is no longer effective. Not just for one bacteria too but for all three. When the antibiotic was first introduced, probably around 1970-1975 the world's population started using the biotic which helped to slow down the bacteria. However, like most people, once they start to see that they are getting better, they stop taking the drugs. This leaves the bacteria with the ability to fight against the antibiotic. Once the population feel better for a small amount of time, they will start to become ill once more. This is due to some of the bacteria being left behind that found a way to fight against the biotic. The world's population will start getting ill again and start taking the biotic. This time, the bacteria have mutated itself and the percentage of the resistance increase. This time it increases massively as we can see (near the middle) on the graph. Bacteria can be treated with antibiotics as they are considered as a living organism. They are considered this because they can respirate, reproduce, grow, etc. Virus however can only reproduce and is not concidered as a living organism. If doctors cannot come up with a new antibiotic to help with these 3 bacterical infections, the world's population would get very ill, and the biotics will not be able to even slow down the growth by even just 1%. The bacteria can easily fight off the biotics as it now has a new mutation which is to fight off the antibiotics. Once these bacteria reproduce, they will pass on the immunity onto the offspring which means that when the new is carried onto the back

M5

## QUESTION THREE: SOOTY MOULD

Sooty mould is a common fungus that grows on beech/tawai trees in New Zealand. It feeds on honeydew, which is an energy-rich substance made by insects that also live on the trees.

Sooty mould growing on the trunk of a beech/tawai tree.

www.sciencelearn.org.nz/images/1738-sooty-mould

Sooty mould hyphae as seen under a microscope.

www.researchgate.net/publication/264275370_The_sooty_moulds

One environmental factor that affects the growth of sooty mould is humidity (amount of water in the air). A student collected some data to investigate the effect of humidity on sooty mould growth. Her results are in the table below:

| **Humidity (amount of water in the air)** | **Percentage cover of sooty mould on beech/tawai trees** |
|---|---|
| High humidity | Average of 90% of trunks covered |
| Medium humidity | Average of 50% of trunks covered |
| Low humidity | Average of 20% of trunks covered |

Discuss how environmental factors, life processes and the structure and function of a fungus such as sooty mould, work together to allow it to live successfully on New Zealand's beech/tawai trees.

In your answer:

- describe the structure and function of a fungus such as sooty mould
- explain the environmental factors required for a fungus such as sooty mould to live successfully
- explain how a fungus such as sooty mould feeds, grows, and reproduces
- discuss how the life processes of sooty mould are affected by humidity and other environmental factors such as temperature, oxygen availability, nutrients, moisture and competition.





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The structure of the sooty mould will look much like a plant/fungi but it is in the way it lives
not where near the same as plants. It have spores, sporangium, sporangiophoe and hyphae. The purpose of the hyphaes is for digestion. The digestion occur through a process called extra-cellular disgestion. This is when the enzymes from the tip of the hyphaes are send out onto the food particles. The food particles is then broken down into molecules by the enzymes and then absorbed back into the hyphae to be used to make energy. The sporangiophoe acts as something to hold the sporangium containing the spores up for when it is ready for reproduction. The sporangium acts as a protection for the spores as it keeps it safe but when it is the spores out
ready to reproduce, the sporangium will burst and release the spores in all directions. The spores are pretty much like the offspring. Once the sooty mould is ready to reproduce, the spores will be send away to regrow and reproduce. For the sooty mould to be able to grow and reproduce, it needs the perfect environment that consist of humidity, warmth, moisture and rich in nutrients. If one of these environmental factos was not perfect, the fungus will still be able to grow and reproduce but it might be very slow. For sooty mould to grow and reproduce it needs to be able to feed. This fungus feed through what is called extra-cellular digestion. I have explained this digestion above. For the fungus to grow, it starts of with the sporangiophoe growing upwards. This will happen very quickly. At the end of these sporangiophoe, sporangium are formed and this is when the reproduction comes in as a part of the growing. Inside the sporangiums, spores will be formed. Once there are enough spores being make and the fungus is ready to reproduce, the sporangium will burst which sends the spores shooting out in all directions. The spores will then feed, grow and reproduce again and this process will repeat itself. Sooty mould reproduce asexually which makes it easy for them to reproduce and grow quickly. They also don't need to waste time in Δ carried onto the back?

M5

**Extra paper if required.**
**Write the question number(s) if applicable.**

QUESTION NUMBER

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seen

1 → * it would stop/prevent any other bacteria/virus from getting into the food as some micro organisms can be transmitted by common vehicle. For example, bacteria/virus travels through air and can land onto the food. By keeping the yoghurt in the fridge, it reduces the percentage of it's growth by more than 70%.

seen

2 → * bacteria grow it would already be able to fight off the antibiotic. To reduce the resistance of the bacteria or even stop it, New biotics needs to be created. The new biotic will be new to our population and the bacteria's population. Once the world's population start taking the new biotic, the percentage of the resistance of the graph will reduce. To stop the infection for possibly for ever, there need to be more than one new biotic to cure the infection. This is so that if the bacteria starts to become immune to one of the new antibiotics, we can using switch into a different drug which will definitely stop the bacteria.

seen

3 → Δ trying to find a mate and does not have to go through the process of mutation, fertilisation, etc. Since there are plenty of beaches and tawai trees in New Zealand, it is extremely easy for sooty mould to grow and reproduce (keep their population going). I would have to say that sooty mould does not need oxygen for respiration as they like to live in areas that is humid (loads amount of water in the air). This makes them respirate anaerobically. Respirating without oxygen may leave the fungus making not that much energy but it does not effect sooty mould as they can take time in reproducing and growing because no one is going to disturb them. This fungus can find nutrients easily as it would be carried to them by the water in the air.

Respirating anaerobically- sugar → alcohol + water + some energy

Respirating aerobically- sugar + oxygen → carbon dioxide + water + lots of energy.

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| Subject: | Biology | Standard: | 90927 | Total score: | 16 |
|---|---|---|---|---|---|

| Q | Grade score | Annotation |
|---|---|---|
| 1 | 6 | This response is M6 because it demonstrates understanding through description and also demonstrates in-depth understanding through explanation (saying how or why something occurs) of two ideas. The response describes the process of anaerobic respiration, the environmental factors required for the growth of bacteria in the yoghurt and some of the other life processes of bacteria. The response demonstrates in-depth understanding through explanation of how bacteria feed and the importance of storing the yoghurt in an airtight container. |
| 2 | 5 | This response is an M5 because it demonstrates understanding through description and also demonstrates in-depth understanding through explanation of one idea. The response describes the trend in antibiotic resistance as shown in the graph, the idea of the development of antibiotic resistance and ways resistance is increased. The response demonstrates in-depth understanding by explaining how antibiotic resistance occurs. |
| 3 | 5 | This response is an M5 because it demonstrates understanding through description and also demonstrates in-depth understanding through explanation of one idea. The response describes the structure of a fungus, fungal reproduction, the environmental factors required for sooty mould to live successfully. The response also provides a weak explanation of how fungi feed. |