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1

90927



909270



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## Level 1 Biology, 2015

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

2.00 p.m. Friday 20 November 2015  
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 2–12 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**

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## QUESTION ONE: MICROBES AND ILLNESS

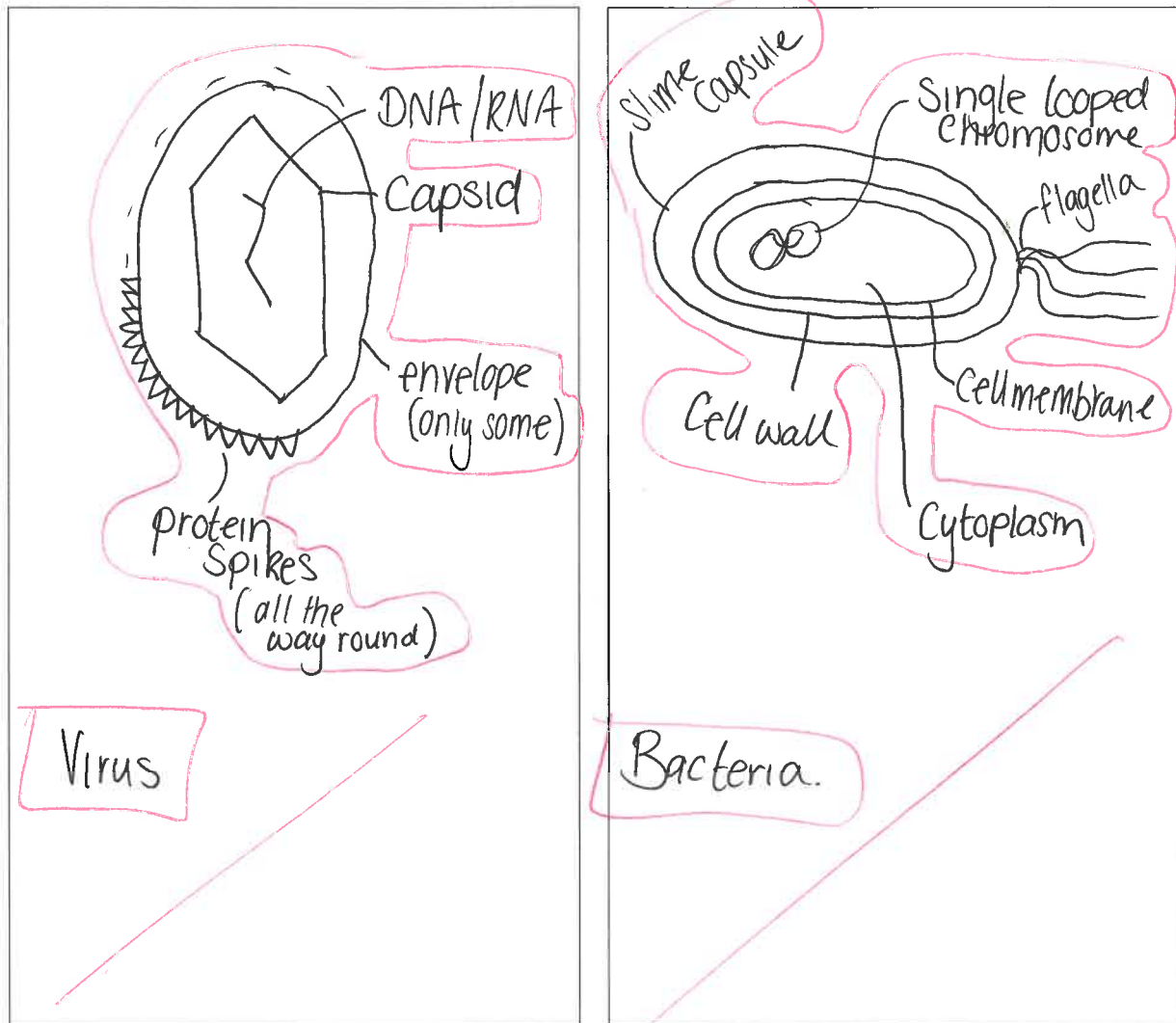
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Two students, Manaaki and Angela, were sick and went to the doctor on the same day.

Manaaki was told that he had the common cold, which is caused by a viral infection, and was advised to stay home and rest.

Angela had a sore throat, which is caused by a bacterial infection, and was prescribed a 10-day course of antibiotics.

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



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4SUWISUadMFkVdSi`S`V`STWW

- (b) The symptoms developed very differently for Manaaki and Angela before they saw the doctor. Manaaki's symptoms (caused by a virus) had become worse suddenly in the morning, while Angela's symptoms (caused by bacteria) became worse gradually throughout the day.

Explain why Manaaki developed the symptoms more quickly than Angela.

In your answer you should:

- explain how the reproduction of viruses and bacteria affected how quickly Manaaki and Angela developed the symptoms
- compare and contrast the way viruses and bacteria reproduce, including their requirements of energy. **Explains the reproduction of bacteria and viruses links to speed of reproduction**

Bacteria reproduce by Binary Fission, a process similar to mitosis. Each reproduction results in 2 genetically identical daughter cells. In optimum conditions, the bacteria population will double every 20 minutes. Therefore will develop over time (a day) as Angela has discovered.

Manaaki's symptoms would have developed quicker than Angela's because a virus particle replicates quickly creating many ~~genetic~~ genetically identical copies at once. A virus particle uses a host cell's resources to replicate. This is because it is not living, therefore can't replicate on its own. The virus particle lands on the host cell and injects its genetic material (either DNA or RNA) into the cell, thus changing the way the cell works and making it diseased. The cell then replicates the virus's genetic material and capsid. The pieces then assemble inside the cell before breaking it and repeating the pathogenic process. As lots of virus particles are made at once it results in the virus spreading quickly which means it can affect the host quicker than ~~a bacterium~~ bacteria can.

How  
symptoms are  
caused by  
viruses

The way a virus replicates requires a lot of energy and many resources, which is why it is a pathogen they are pathogenic. They disease host the host as they change the way certain cells work. They then use all the cells resources and when they have finished they kill the host cell by breaking out.

The way bacteria ~~pro~~ reproduce is not similar to the way a virus replicates. Bacteria is not pathogenic, therefore doesn't kill any cells during reproduction.

The parent cell's genetic material is replicated and the cell increases in size. The cell wall then pinches in until both sides meet separating the two cells.

Could have improve the answer by adding how bacteria cause symptoms linked to population growth and production of toxins.

- (c) Angela was prescribed antibiotics to help her get better. Some bacteria can become resistant to some antibiotics.

Explain how antibiotics work on bacteria and how bacteria can become resistant to antibiotics.

In your answer you should:

- explain how life processes of bacteria can be affected by antibiotics
- explain how bacteria can develop antibiotic resistance if Angela did not complete her 10-day course of antibiotics
- explain how this process might affect Angela's symptoms.

Bacteria are living prokaryotic unicellular microorganisms. They follow the processes of MRS GREN. When antibiotics are introduced to the environment it stops or ~~A~~ changes the way some of these processes are carried out, resulting in the bacteria not being able to survive.

It is important that a full course of antibiotics are taken, otherwise the bacteria could become resistant.

If only 8 days of a 10 day course of antibiotics is taken, the surviving bacteria will continue to reproduce with the changes the antibiotics made. As they reproduce <sup>(adapt)</sup> they are able to alter ~~the way~~ the way they work to the new environment that they were exposed to.

This change ~~will~~ in the bacteria will result in survival the next time the antibiotic is used as they are now resistant.

Describes how bacteria become resistant to antibiotics.

Could have improved the answer by explaining how antibiotics work giving an example how one of the life processes are affected. The candidate could have also linked mutations as a way bacteria become resistant.

M5

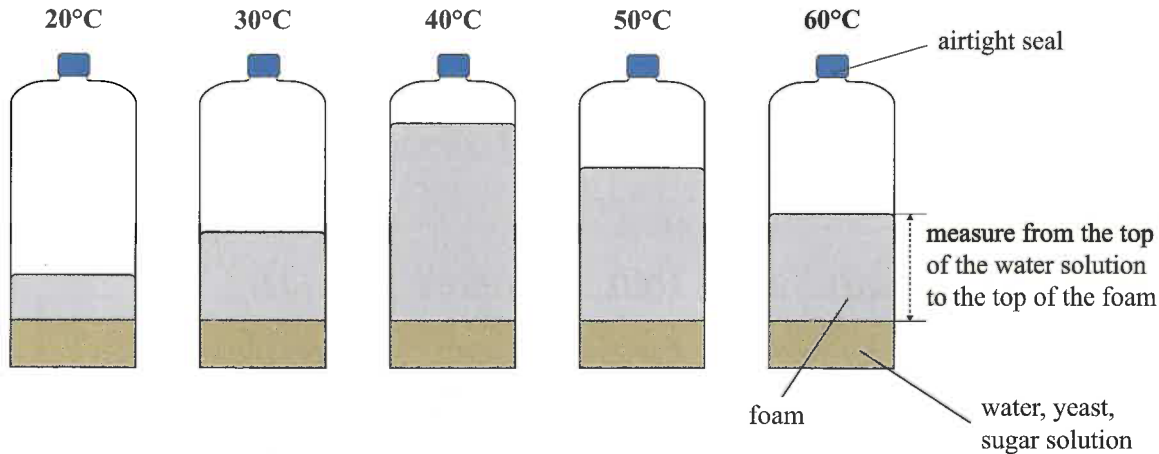


## QUESTION TWO: THE SCIENCE OF MAKING BREAD

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The following experiment was set up by a group of Year 11 students who wanted to investigate respiration in fungi (yeast) cells. When fungi (yeast) are mixed with sugar and water, foam forms, and may be measured to indicate the amount of carbon dioxide produced.

### Year 11 Fungi Respiration Experiment



The type of yeast the students used was dried active yeast.

The instructions say to refrigerate the container after opening. There is an **airtight** seal on the top of the container under the lid that must be removed before use.

Discuss what the students can determine about respiration from their experiment.

In your answer you should:

- describe three conditions required for the growth of fungi (yeast)
- describe anaerobic respiration
- explain how fungi (yeast) gain their nutrients
- identify the optimal temperature for growing fungi (yeast) as shown in the experiment above, and explain how this can be applied to the production of bread and the storage of fungi (yeast)
- discuss the importance of keeping the fungi (yeast) sealed and refrigerated once opened.

Conditions of fungi growth are described as moist, warmth, they could have improved by adding nutrients

Growing yeast requires a moist, warm, neutral environment that is not too acidic or not too alkali. There needs to be moisture or the yeast will dry out and become dormant (the state they were already in). They need to be in temperatures around 40-50°C as shown in the experiment results. This environmental condition is important because

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Anaerobic respiration/fermentation is described and the effect of temperature of enzymes is explained.

if it is too cold the yeast will go into a dormant state, where as if it is too hot, they will become denatured/killed and won't be able to carry out any more processes, such as anaerobic respiration. The environment they are in also need to have a pH of around 7, so neutral. This is because if it is too acidic or too alkali it can denature and kill the yeast.

Yeast and Fungus gain their nutrients through the process of extra-cellular digestion. They secrete digestive enzymes which break up/digest the substrate. ~~the~~ The digested substrate is then absorbed by diffusion back into the cells.

With this nutrients, yeast are able to complete anaerobic respiration. In this situation they would do fermentation.

Glucose  $\xrightarrow{\text{yeast}}$  ethanol + carbon dioxide (+energy)

In this reaction yeast is a catalyst. It feeds on the sugar (glucose) and as a ~~byp~~ ~~by~~ byproduct, excretes ethanol and carbon dioxide. By doing this, they gain energy.

The yeast needs to be sealed and refrigerated once opened as ~~the~~ the cool temperature will slow down any processes. ~~And~~ and keeping it sealed will stop any more oxygen getting in.

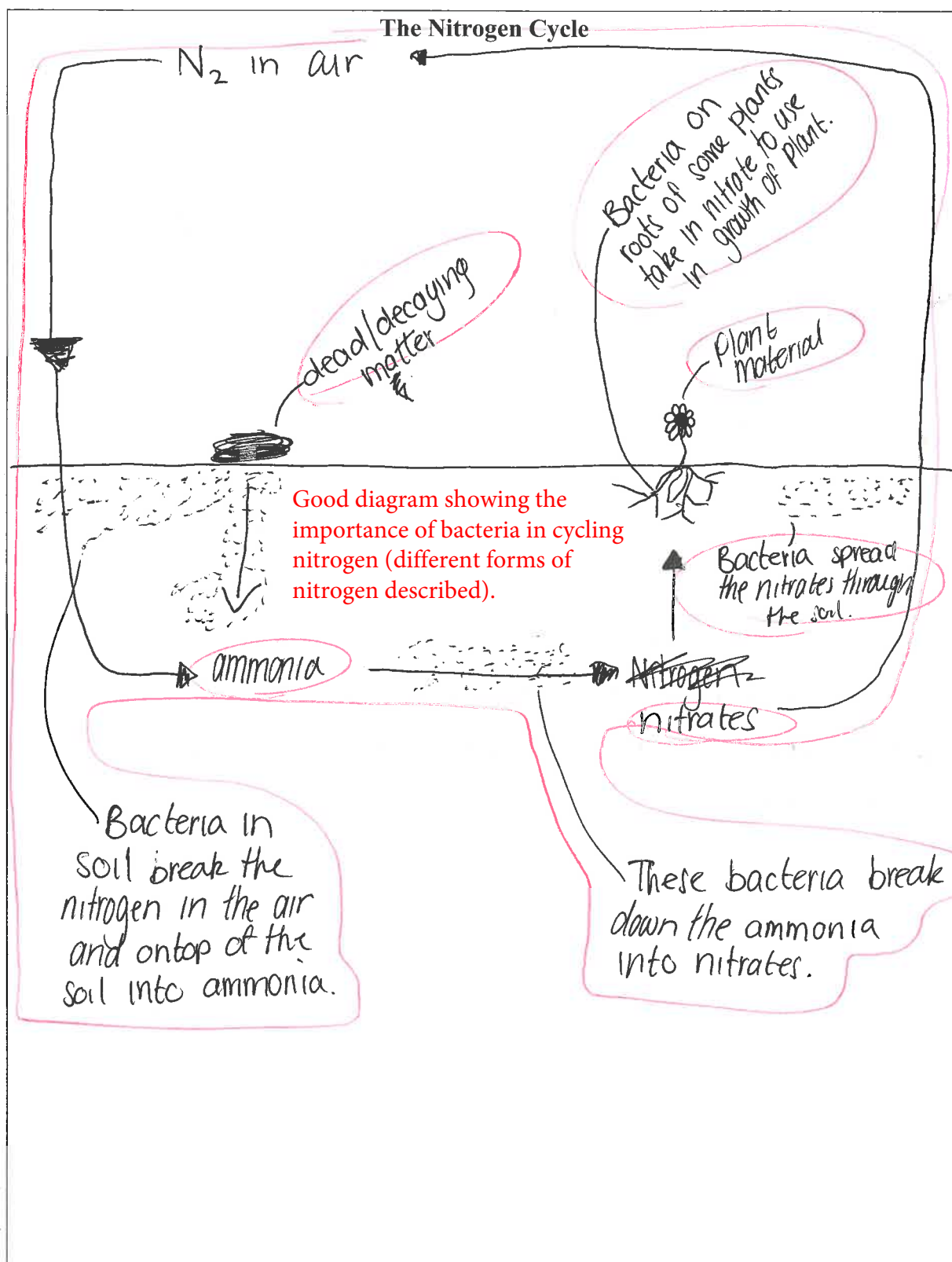
### QUESTION THREE: A PILE OF COMPOST

ASSESSOR'S  
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Compost is decayed organic matter. Composting is the process carried out by bacteria, turning organic matter such as vegetable matter and manure into compost. A successful compost heap requires good air flow.

Bacteria play a big part in the nitrogen cycle and the carbon cycle.

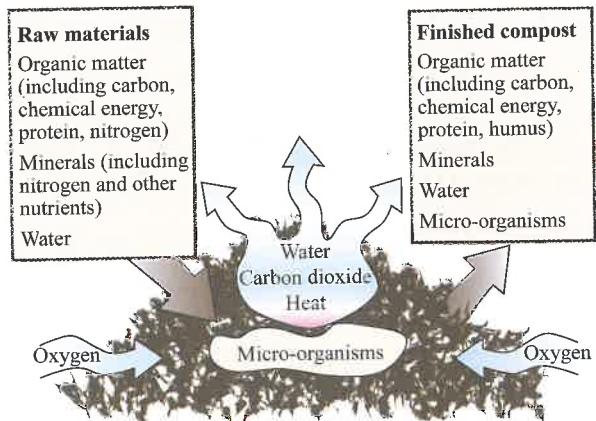
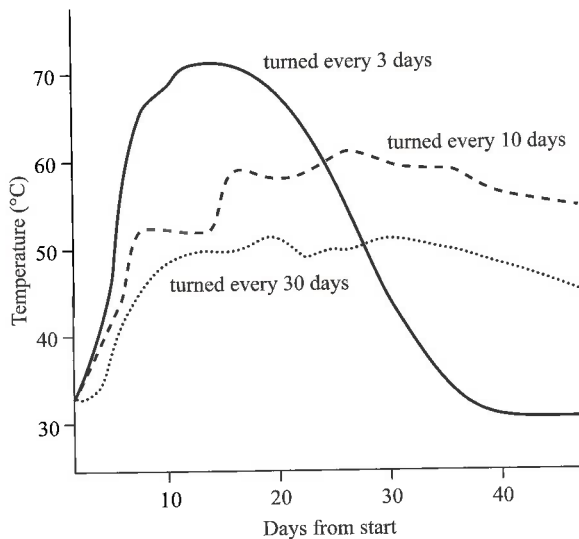
- (a) Draw a labelled diagram of the nitrogen cycle that shows the role of **bacteria** in this cycle.





(b)

### The Carbon Cycle: How the frequency of turning the compost affects its temperature over a period of 40 days



Adapted from: <http://goo.gl/sVfgZ>

Discuss the role that microbes play in releasing carbon dioxide from the compost heap shown above.

In your answer you should:

- name the type of bacteria involved in breaking down the dead and decaying organic material
- describe how the frequency of turning the compost changes the temperature of the compost, as shown on the graph above
- explain the effect of turning over the compost heap on the microbes, using the information from the graph above.

Saprophyte

Saprophyte

Names the type of bacteria as being saprophytes/decomposers.

Links turning over the compost to allowing more oxygen into the compost and to aerobic respiration explaining the increase in temperature related to the graph above.

Saprophytic bacteria feed on dead or decaying matter. They respire by ~~an~~ aerobic respiration which turns glucose into carbon dioxide and water. Which also releases energy in the form of heat. The more the compost heap is turned, the more oxygenated it becomes which results in more aerobic respiration which means more energy is released therefore the compost becomes hotter. The more often the compost heap is turned, the more oxygen becomes available which encourages aerobic respiration, instead of anaerobic respiration which results in methane gas.

Explains the decrease in temperature as a result of the increase in toxins excreted by bacteria.

being produced making the compost smelly and often slimy. The more the compost is ~~turned~~ turned also results in the heat ~~to~~ being spread around so it doesn't get too hot in one place killing the micro-organisms. The same goes for the toxins excreted. The more its turned the toxins excreted by the micro-organisms becomes spread out so it doesn't become too toxic in one place.

(c) Analyse the importance of the bacteria in cycling carbon and nitrogen in the compost heap.

The presence of bacteria in carbon and nitrogen cycles is very important. As if no bacteria were present, nothing would break down the organic matter which wouldn't release the nutrients back into our soils that are needed to be able to grow new organic materials.

Describes what the bacteria do in the nutrient cycles but not specific enough and could have improved the answer by linking in photosynthesis and proteins which ties in both carbon cycle and nitrogen cycle to the importance to the ecosystem.

M5

Extra paper if required.  
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Merit

TOTAL

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## QUESTION ONE: MICROBES AND ILLNESS

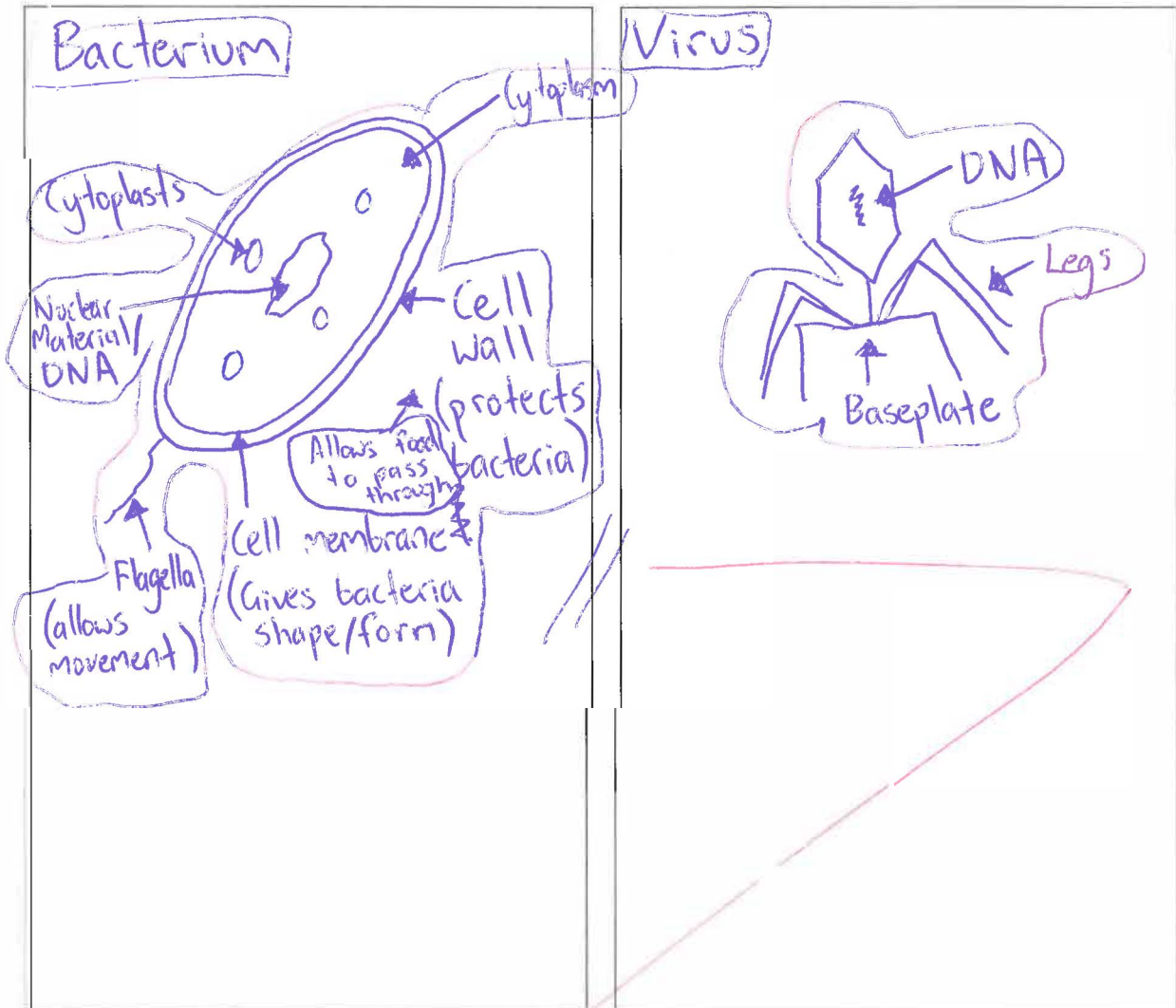
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Two students, Manaaki and Angela, were sick and went to the doctor on the same day.

Manaaki was told that he had the common cold, which is caused by a viral infection, and was advised to stay home and rest.

Angela had a sore throat, which is caused by a bacterial infection, and was prescribed a 10-day course of antibiotics.

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



The bacteria and virus are drawn correctly with the bacteria labeled correctly with the virus missing the protein capsule/ sheath.



- (b) The symptoms developed very differently for Manaaki and Angela before they saw the doctor.

Manaaki's symptoms (caused by a virus) had become worse suddenly in the morning, while Angela's symptoms (caused by bacteria) became worse gradually throughout the day.

Explain why Manaaki developed the symptoms more quickly than Angela.

In your answer you should:

- explain how the reproduction of viruses and bacteria affected how quickly Manaaki and Angela developed the symptoms
- compare and contrast the way viruses and bacteria reproduce, including their requirements of energy.

Uses correct terminology when describing bacteria reproduction.

Angela's symptoms were caused by bacteria. Bacteria use a process called binary fission in order to reproduce. Binary fission only occurs if there is enough space, food, oxygen, moisture, warmth and the right pH. Binary fission occurs when the mother cell (the original bacterium) splits into two new daughter cells (newly formed bacterium). Since the bacterium has caused sickness, it is pathogenic. Manaaki on the other hand has been infected with a virus. Viruses do not necessarily reproduce, but rather replicate themselves. Viruses replicate by using living cells within living things. The virus attaches itself to the living cell and injects its DNA into the cell. The cell then replicates many clones of the virus within itself, eventually becoming too full and bursting, releasing new viruses and killing itself. ~~Since~~ Angela's bacterium inside her body is being created

Correct terminology when referring to virus reproduction

Virus replication described.

and faster.  
faster ~~reproduce~~ ~~reproduce~~ (due to the bacterium reproducing), causing many toxic waste products from the bacteria to fill in her body. However, ~~some~~ the white blood cells and antigens inside her body are being put to work. The Antigen produces antibodies, which locate and mark the bacteria. The white blood cells then devour the bacteria and destroys it, which causes Angela to become sick (sickness shows the immune system is working). However Manaakis viruses are much much harder to detect and remove due to them not really being alive. Since manaakis immune system takes much longer to locate these viruses, it makes the symptoms come out much earlier. When the virus reproduces, it uses much less energy than the bacterium as it does not require too much energy to latch onto a cell. //

This candidate could have described how viruses use the host cells energy and do not themselves respire so do not require the energy compared to the bacteria cells which need to respire to produce energy to reproduce and grow.

- (c) Angela was prescribed antibiotics to help her get better. Some bacteria can become resistant to some antibiotics.

Explain how antibiotics work on bacteria and how bacteria can become resistant to antibiotics.

In your answer you should:

- explain how life processes of bacteria can be affected by antibiotics
- explain how bacteria can develop antibiotic resistance if Angela did not complete her 10-day course of antibiotics
- explain how this process might affect Angela's symptoms.

Antibiotics help reduce the amount of bacteria that is inside a human body. Antibiotics travel throughout the body and targets the living bacterium. The antibiotics then destroy the cell wall of the bacteria, which then stops the movement, reproduction, ~~and respiration~~ and respiration of that bacteria cell. Once first used, the bacteria notice the antibiotics and begin to mutate. If Angela does not complete the 10 day course of antibiotics, the bacteria would have become used to the antibiotic, and mutate to withstand it. This means that the symptoms that Angela gets could become worse, and more of the symptoms could even come into play.

Explains that the antibiotics destroy the cell wall of the bacteria. (one of many ways antibiotics work that were accepted) stopping respiration and reproduction.

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Idea that bacteria can mutate and become resistant which would mean the symptoms become worse.

This candidate has explained both virus replication and binary fission and antibiotic resistance M6 was awarded.

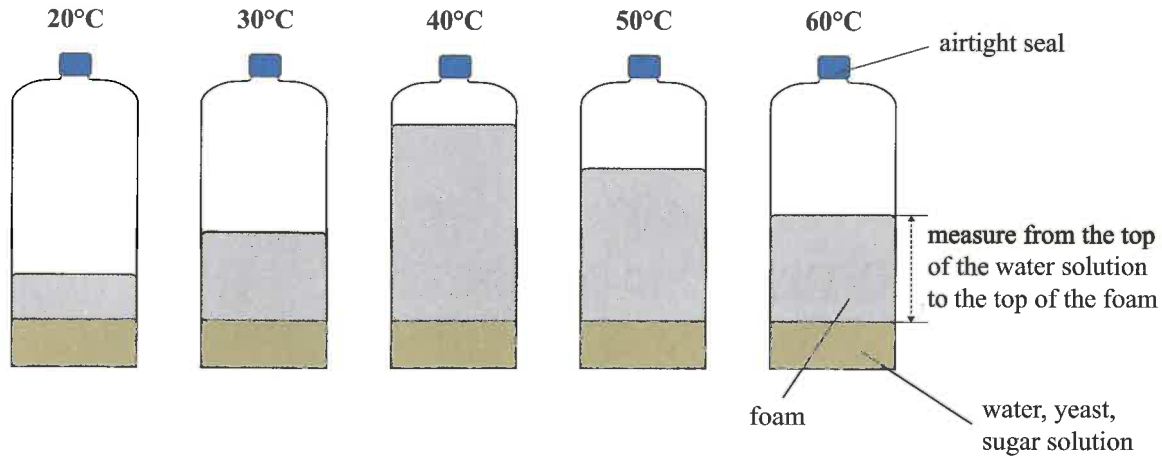
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## QUESTION TWO: THE SCIENCE OF MAKING BREAD

The following experiment was set up by a group of Year 11 students who wanted to investigate respiration in fungi (yeast) cells. When fungi (yeast) are mixed with sugar and water, foam forms, and may be measured to indicate the amount of carbon dioxide produced.

### Year 11 Fungi Respiration Experiment



The type of yeast the students used was dried active yeast.

The instructions say to refrigerate the container after opening. There is an **airtight** seal on the top of the container under the lid that must be removed before use.

Discuss what the students can determine about respiration from their experiment.

In your answer you should:

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In order for the yeast to reproduce, ~~the~~ moisture, food and space is needed. Anaerobic respiration is when the bacteria/fungi (yeast in this case) does not require oxygen in order to respire. Yeast ~~gains~~ gains their nutrients for respiration by ~~the~~ sending out enzymes.

Moisture and (nutrients) food are described as conditions required. they could have improved by mentioning warmth.

Describes that anaerobic respiration requires no oxygen.



onto the nutrient source and then absorb the enzyme once it has broken the food down. ~~This causes~~ The food in this instance is sugar, which is turned into alcohol once the yeast has absorbed the nutrients. This experiment shows us that the 40°C mark contains the most amount of foam, meaning that the most amount of respiration occurred here and is the optimal temperature. This means that if you leave bread dough to rise in a 40°C area, it should ~~grow~~ rise to the highest it can, due to the reproduction of the yeast. Once yeast is open, it is possible ~~to~~ for some of the yeast to die, which means you must keep it in a cool area (fridge). Once ~~yeast is~~ <sup>yeast</sup> is at a cold temperature, it will become dormant, meaning it basically goes to sleep and stops reproducing/respiring without dying, so keeping yeast in a fridge will keep it fresh.

Describes lower temperature lower the reproduction and respiration could have linked this to why due to slower movement of particles and therefore less respiration so (enzymes) move more slowly so less energy available for reproduction. Two explanations M5 awarded

Links the amount of foam to the amount of respiration occurring. Could have improved by linking the amount of foam to the amount of CO<sub>2</sub> produced by fermentation (anaerobic respiration).

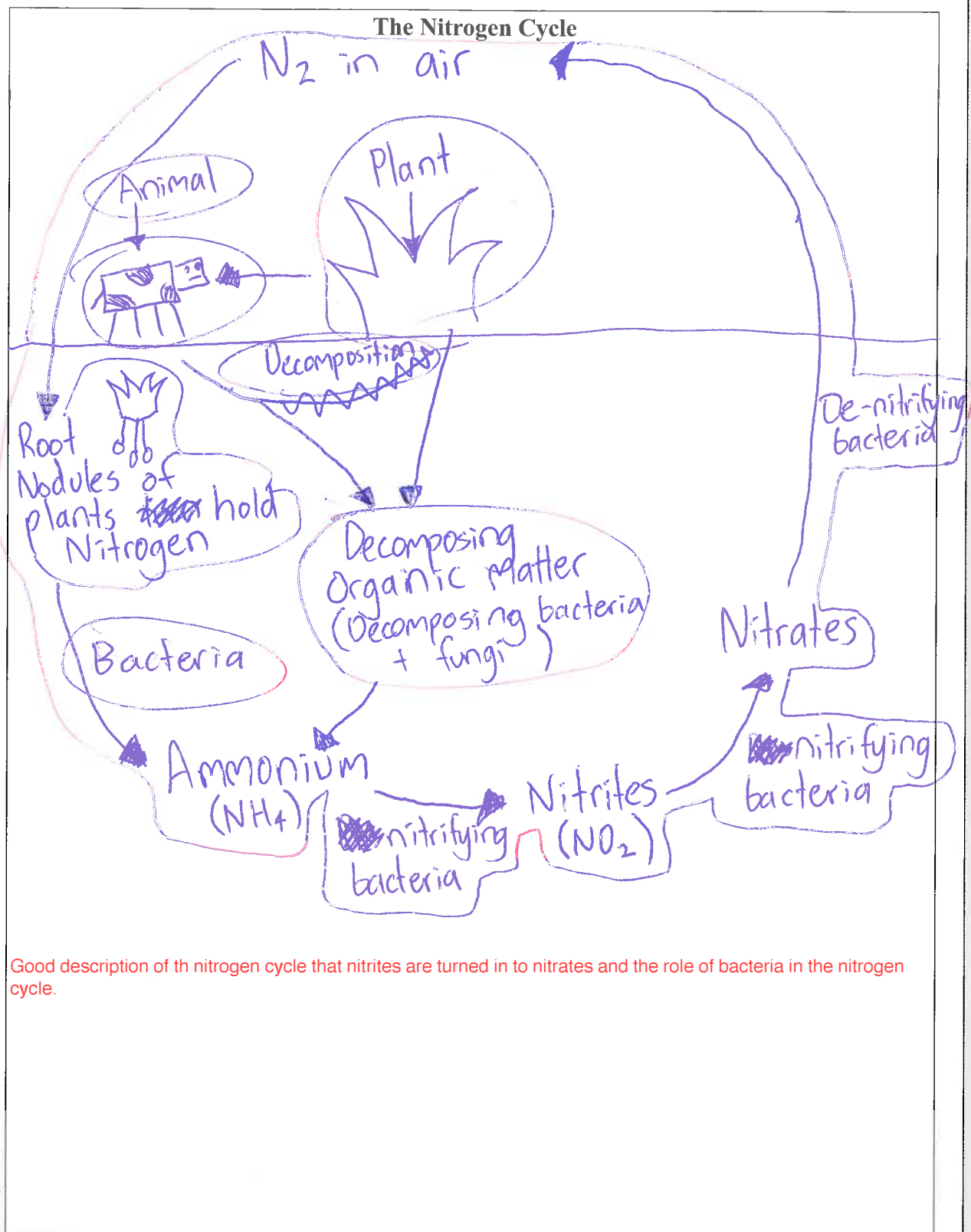


### QUESTION THREE: A PILE OF COMPOST

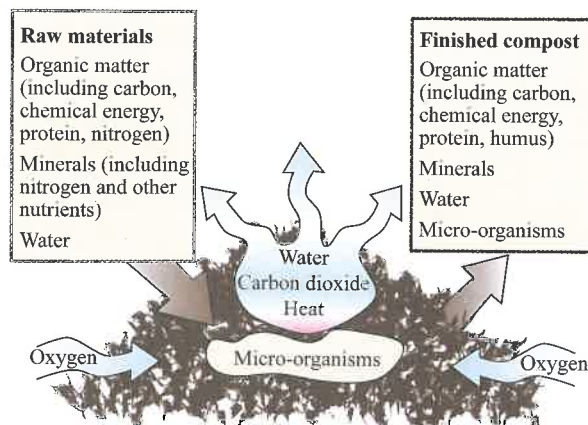
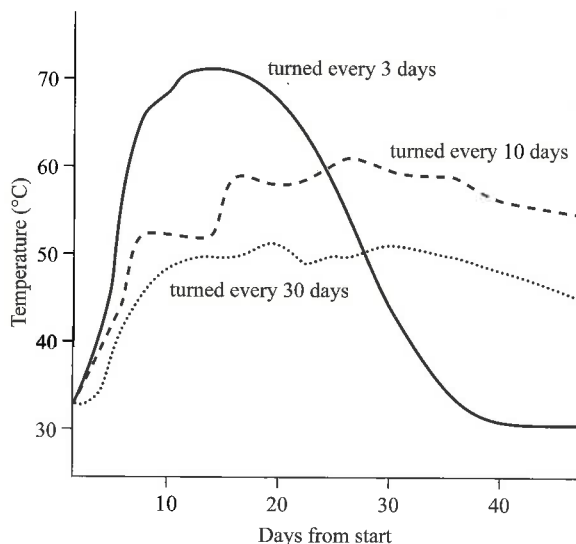
Compost is decayed organic matter. Composting is the process carried out by bacteria, turning organic matter such as vegetable matter and manure into compost. A successful compost heap requires good air flow.

Bacteria play a big part in the nitrogen cycle and the carbon cycle.

- (a) Draw a labelled diagram of the nitrogen cycle that shows the role of **bacteria** in this cycle.



(b) **The Carbon Cycle: How the frequency of turning the compost affects its temperature over a period of 40 days**



Adapted from: <http://goo.gl/sVfgZ>

Discuss the role that microbes play in releasing carbon dioxide from the compost heap shown above.

In your answer you should:

- name the type of bacteria involved in breaking down the dead and decaying organic material
- describe how the frequency of turning the compost changes the temperature of the compost, as shown on the graph above
- explain the effect of turning over the compost heap on the microbes, using the information from the graph above.

The type of bacteria is described as decomposers

The bacteria that break down dead and decaying organic material are called decomposers. Decomposers are helpful in composting as they break down plants and food scraps into compost (nutrients). If the compost is turned more frequently, more oxygen is able to get into the soil and bacteria. This means that the bacteria can respire more frequently as aerobic bacteria need oxygen. ~~more~~ Since the bacteria is respiring more,

it is creating more heat energy, which heats up the soil. We can see on the graph that the bold line (turned every 3 days)\* gets to about  $70^{\circ}$  in fifteen days due to the heat energy, but then decreases due to the bacteria not having sufficient needs to respire. We can also see the the small little dots (turned every 30 days) ~~does~~ only reaches a high temperature of  $50^{\circ}$  due to not enough oxygen being present.

(c) Analyse the importance of the bacteria in cycling carbon and nitrogen in the compost heap.

Carbon and nitrogen are important things needed in the compost heap as ~~it~~ it would not function properly without it. Carbon <sup>and nitrogen</sup> is needed in order to create new nutrients for the plants and animals to use. The bacterium within the soil ~~cycle the carbon and nitrogen into the soil so that the Ammonia from the~~ breaks the organic matter into Carbon and Ammonia, which is then used by nitrifying and de-nitrifying bacteria in order to create ~~new~~ new nutrients in the soil for plants and animals to use. Without the bacteria, nitrogen and carbon would not be reused.

needs to link this to nitrogen for plants and animals to use for making essential proteins and carbon for plants to use in photosynthesis to make glucose and oxygen which are important for all living organisms in the ecosystem.

explains oxygen linked to respiration and temperature

M6

Extra paper if required.  
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QUESTION  
NUMBER

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