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Level 1 Biology, 2015

90928 Demonstrate understanding of biological ideas relating to the life cycle of flowering plants

2.00 p.m. Friday 20 November 2015
Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of biological ideas relating to the life cycle of flowering plants.	Demonstrate in-depth understanding of biological ideas relating to the life cycle of flowering plants.	Demonstrate comprehensive understanding of biological ideas relating to the life cycle of flowering plants.

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 2–11 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

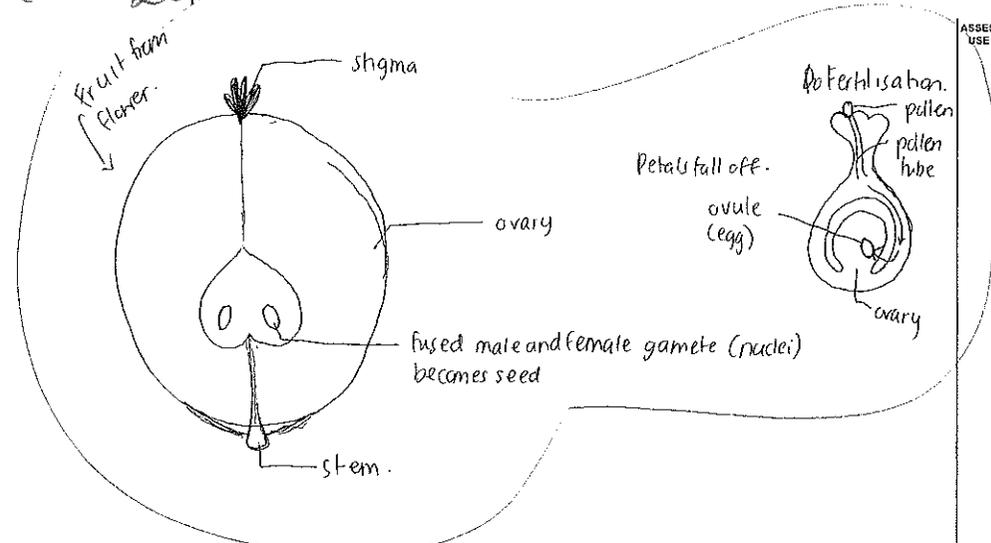
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QUESTION ONE: POLLINATION, FERTILISATION, SEEDS, AND FRUIT

The pūriri is one of the few New Zealand native trees with colourful flowers. Birds, like the tūi, pollinate the flowers of the pūriri.

After pollination, followed by fertilisation, fleshy fruits develop with seeds inside.

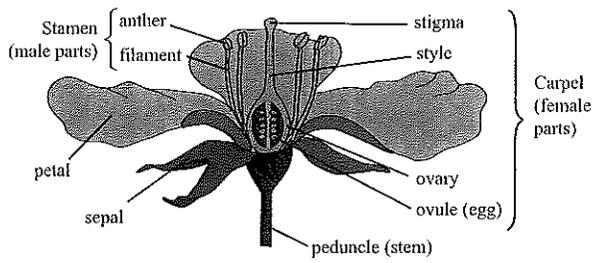


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Pūriri flowers
https://farm5.staticflickr.com/4084/5050412356_8e85e09524.jpg

Pūriri fruit
http://ketenewplymouth.peoplesnetworknz.info/image_files/0000/0001/3929/Vitex_lucens_fruit_Puriri-2.JPG

Generalised flower diagram



Discuss why the processes of pollination and fertilisation are important in the life cycle of a flowering plant, and how different parts of the flower develop into the seed and the fruit in plants such as the pūriri.

In your answer you should:

- explain how the processes of pollination and fertilisation occur in a flower
- explain why the processes of pollination and fertilisation are important to the plant
- explain how the parts of the flower develop into a seed. Include names of parts of the flowers that are involved in this process
- explain how a fruit forms once fertilisation has occurred in a flower. Explain why seed and fruit formation are important to the plant.

You may use labelled diagrams to help you explain your answers.

In pollination, the plant has to attract pollinators such as bees, butterflies, moths and small animals (birds, ~~insects~~ ^{rodents}) so that their pollen could be transferred to another plant, while the plant receives pollen from another plant. This is done by producing flowers with brightly colored petals which will attract a potential pollinator's attention, or create glucose syrup which is known as nectar, and the pollinators are attracted to this ^{because it is tasty} ~~then the~~ ^{sweet} pet. Animals who are active at night, will be attracted to smell, so some flowers produce a smell to attract pollinators like moths. Some flowers also produce smells to attract pollinators like flies, as they are attracted to the stronger smells, instead of ~~light~~ color and nectar. ^{Some plants are wind pollinated, and would have long styles and stigmas, to catch the pollen passing by using the wind so colors and smells and nectar are unnecessary for these plants.} Pollination is important to the plant for sexual reproduction in producing offspring that would ensure the species survival, as variation would occur during pollination from flowers receiving different (unique) pollen from other compatible flowers. The variation would then help the species to survive if there were any environmental changes, as the variation in the plants

There is more space for your answer to this question on the following page.

ⁱⁿ animal pollination, the pollinator collects pollen by having the anther (where pollen is produced) rub against its leg, and the pollen will stick onto the stigma of the next flower the pollinator goes to

could mean that the plant could adapt to the change.

Fertilisation is the fusion of the male and female plant gametes and this ~~is done~~ starts when a stick of stigma catches a pollen / a pollen sticks to the stigma. The pollen then penetrates the stigma surface and creates a pollen tube down the style, with the male plant gametes travelling in the pollen tube. The pollen tube and male gametes are travelling down the style and into the ovary, following a trail of chemical the female plant gametes (ovules) have secreted. Once the male gamete reaches the female plant gamete, they fuse and so form a seed. Fertilisation is important to the plant in creating seeds, which would ~~become~~ grow into plants themselves, and keep the species surviving, whilst spreading to cover more land for growth. The fused male plant gamete and female plant gamete ~~form~~ form a seed, and it they are found in the ovary of a plant. Once fertilisation is complete the fused ~~male~~ ovary begins to swell and expand, still containing the fused male and female plant gamete inside, which as stated before, will form/create a seed. ~~Then~~ The stamen, stigma and style fall off, and so do the petals and the sepal during the fruit formation. The only parts of the flower left, are the ovary with the seeds, inside, still attached to the plant with the peduncle (stem). The ovary keeps swelling and expanding, until it becomes the edible part of the fruit. The seed and fruit formation are important ^{to the plant} in the dispersal of seeds, so that the species survival is ensured, and ~~it~~ ^{they} will cover more area for growth. Forming the fruit such as the Pūiri is important in the seed dispersal using animals, so the ovary should form bright colors to attract an animal such as the bird, and the seed must have a tough coat to withstand the digestion of the animal, so that it could be excreted, land on the ground and grow*. The ovary is also made to be eaten, so that the animal would also eat the seed inside, and disperse it.

* with the bird's excretion as manure for germination.

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M5

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The examination continues on the following page.

QUESTION TWO: GERMINATION

The picture below shows a bean seed germinating, and the graph next to it shows how the dry mass and the live mass of the seed change over time.

Discuss how environmental factors and the parts of the seed work together to allow germination to occur.

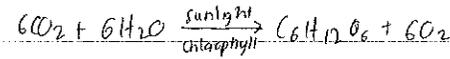
In your answer you should:

- describe the process of germination
- name the environmental factors required for germination to occur
- explain why these environmental factors are required for germination to occur
- explain how named parts of the seed are involved in the process of germination
- discuss the changes in the dry mass and the live mass of the seed as it germinates and grows from Day 0 to Day 25.

Germination starts with the ~~emerge~~ water being absorbed through the small micropyle in the testa, causing it to swell. Once it swells, and the testa is able to split open, the radicle emerges first so that it could absorb more water. The radicle grows ^{positive} downward (geotropism) to absorb water, and to also anchor the plant firmly in the soil. The plumule appears soon after, and grows upwards (negative geotropism) while the radicle continues to grow ^{downward} with some root hairs appearing, and also absorbs water. The plumule then reaches the surface where it continues to grow upwards (now positive phototropism because it has sunlight reaching it) and begins its photosynthesis process in making its own food as it now has the sunlight required to do so. The testa and cotyledon are needed less and less as the plant is producing its own food (glucose) and no longer requires the starch reserve for food, nor

the protection of the testa

The environmental factors required for germination to occur are oxygen, water and optimal temperature/warmth. Water is needed during the whole of germination, so that the plant seedling is able to break out of the seed testa, and also when the plant begins the photosynthesis process (when the plumule reaches the surface) as water is a requirement in the photosynthesis.



Oxygen is needed for the plant to convert the glucose into energy, which is then used for growing during germination.

Warmth/optimal temperature is needed for the enzymes in the seedling to germinate and grow, and near the end of germination, the warmth/optimal ~~temperature~~ by converting the oxygen and glucose for energy

temperature will help ~~th~~ is important for the plant also in ~~converting~~ creating energy for growth and functions, ^{as the warmer it is, the faster the enzymes will work.} The enzymes will change shape to accept the water and carbon dioxide molecules, but closer to the right temperature, but there is an optimum temperature where the enzymes reach to do the most conversion, and if the temperature is warmer than that, the enzymes will denature as they will not accept the water and carbon dioxide molecules and the plant's germination will slow down as the photosynthesis is decreasing as well.

The dry mass of the seed decreases from day 0-10 as the removal/decrease of water is making it difficult for the plant to germinate and grow as it needs the water for photosynthesis and growth of the plant when the radicle has emerged from the testa. The live mass ^{meaning its mass increases} however, the dry mass starts to increase from day 10 onwards as it must have been able to reach the sunlight, and grow better even with the lack of water. The live mass on the other hand, is always increasing, as it has more water than the seed with lack of water (dry mass) so it is able to continue its proper germination from day 0-10. Like the dry mass seed, the live mass seed also increases at a faster rate than the previous days as it must have reached the sunlight, and it is able to photosynthesize to grow more and faster, which is why the rate of the mass increase is faster in 10-25 days.

QUESTION THREE: PHOTOSYNTHESIS AND GROWTH

The energy required for plants to grow comes from the process of photosynthesis. The diagram below shows the structures inside a leaf that are involved in photosynthesis. Use this diagram to help you answer the questions below.

http://upload.wikimedia.org/wikipedia/commons/thumb/0/06/Leaf_Tissue_Structure.svg/1280px-Leaf_Tissue_Structure.svg.png

Discuss how different parts of the plant use materials and resources from the environment to allow for photosynthesis and growth.

In your answer you should:

- describe the overall process of photosynthesis
- explain how the different parts of the leaf are involved in the process of photosynthesis
- explain how raw materials from the environment are used by the plant during photosynthesis
- explain what happens to the products of photosynthesis
- explain the link between photosynthesis and the growth of a plant.

Photosynthesis is the process for the plants to make their own food by using sunlight.

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The cuticle is a clear ^{waxy} layer and the top of the leaf structure. It provides a coat for the leaf and is water proof, to prevent ^{too much} water from entering the leaf. The upper epidermis is the layer below the cuticle, and is also protection for the leaf surface. Both layers allow sunlight to seep through, so that the sunlight will reach the layers below to help for photosynthesis. The mesophyll is the middle part of the leaf, and firstly consists of the palisade cells, which contain ^{maximum} chloroplasts with chlorophyll, and this is where the photosynthesis occurs. The palisade cells are oblong and placed vertically to allow maximum amount of sunlight reaching the chloroplasts, as it is the top layer where the most sunlight will reach. The spongy part below the palisade, are spaced out to allow the diffusion of gases and such as oxygen (O_2) to exit, and carbon dioxide (CO_2) to enter, which is needed for the photosynthesis process. There are also vascular bundles consisting of phloem and xylem. Phloem transports the glucose created from photosynthesis to all the areas needed in the plant for functions such as growth. Xylem transports the water required for the photosynthesis process, and also minerals which the plant requires to function properly. The lower epidermis. The spongy mesophyll cells contain only a few chloroplasts, as not much sunlight will reach ^{this} the area compared to the palisade cells which will collect the most amount of sunlight. The lower epidermis and cuticle have the same functions as the upper epidermis and top cuticle, but are made so that no sunlight will escape, and the cuticle is also water proof to make sure not too much water enters the leaf, besides the water absorbed in the roots. The guard cell ^{stoma} is the pore of the leaf, which allows oxygen to exit, and carbon dioxide to enter. The guard cell controls how much enters and exits. The guard cells swell and tighten so that ^{water could evaporated water exits, along with} a lot of carbon dioxide could enter and oxygen ^{exiting,} exits, but closes the stoma on hot days, ^{as} not much water is available, and it needs to preserve water to continue photosynthesis.

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extra paper.

M6

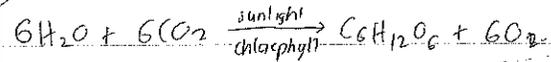
Extra paper if required.

Write the question number(s) if applicable.

QUESTION
NUMBER

3 The process of photosynthesis is shown in this equation:

~~water~~ + carbon dioxide $\xrightarrow[\text{chlorophyll}]{\text{sunlight}}$ glucose + oxygen.



This shows that the raw materials the plants use from the environment, are water which is absorbed in the roots, and carbon dioxide which enters through the stoma. Sunlight acts as a catalyst and chlorophyll is where the water and carbon dioxide is used to create glucose and oxygen.

Oxygen is the plant's excretion, so it diffuses out of the stoma, and is not used by the plant. However, glucose is important for the plant as it ~~creates~~ ^{converts to} energy, and this energy is used for the plant's functions, which includes growth. The extra glucose is then converted to starch, which the plant stores in the roots to use it when it needs it.

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Extra paper if required.

Write the question number(s) if applicable.

QUESTION
NUMBER

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Merit exemplar for AS90928 2015		Total score	16
Q	Grade score	Annotation	
1	M5	This response provides sufficient evidence for M5 because it explains two ideas: the process of pollination and the importance of seed and fruit formation in the life cycle. It also provides a description of fertilisation. In order to gain an M6 this candidate would also have needed to explain a third idea in relation to the question.	
2	M5	The candidate provides sufficient evidence for M5 in this question because they have been able to explain one idea: how the parts of the seed are involved in the process of germination. In order to gain M6 the candidate would need to have explained a further idea. They have attempted to explain how environmental factors affect germination and the trends in dry and live mass but go a bit off track with both of these.	
3	M6	In this response the candidate provides sufficient evidence for M6 because they sufficiently explain three ideas: how the parts of the leaf are involved in the process of photosynthesis, how the raw materials are processed in photosynthesis and the fate of the products of photosynthesis. In order to be awarded E7 the candidate would have needed to discuss how the process of photosynthesis is linked to the growth of the plant.	