Massachusetts Tests for Educator Licensure®

GENERAL CURRICULUM MULTI-SUBJECT SUBTEST

SUPPLEMENTAL SAMPLE OPEN-RESPONSE ITEM WITH SAMPLE RESPONSES AND ANALYSES

NOTE: This sample open-response item is provided as a supplement to the Test Information Guide and Practice Test provided for this test at www.mtel.nesinc.com.

SAMPLE OPEN-RESPONSE ITEM

Use the information below to complete the exercise that follows.

After growing to maturity, a flowering plant produces flowers and then seeds. The offspring produced by the plant is a mix of genetic information from its two parents.

Using your knowledge of life science:

- describe two ways that flowering plants are pollinated; and
- explain the process by which some genetic material from each of the two parent plants contributes to the genetic makeup of the offspring.

SAMPLE RESPONSES AND ANALYSES

Sample Score Point 4 Response

There are various ways that flowering plants are pollinated. One way is by the wind blowing pollen from one plant to another of the same species. The pollen a plant produces is microscopic and extremely light, so even the slightest breeze can distribute it from one plant to another. The ease of movement plus the large quantity of pollen each flower produces (thousands of grains) means that the chances of wind pollination are very high.

Another way pollination can happen is from bees, butterflies, and other insects travelling from flower to flower to suck the nectar from the plant. When insects land on the flower and go after the nectar, they might accidentally rub their legs or antennae against the part of the flower that contains pollen (anther), so the pollen is sticking to them, and then they may accidentally rub that pollen off onto the next flower they visit. These are examples of cross-pollination.

When a grain of pollen from one flower lands on another of the same species, either from the wind or from insect activity, it must land on the pistil for fertilization to take place. Pollen contains the male information that has to get to the eggs inside the pistil. The pollen only contains half of the genetic material from its parent plant, and the eggs only have half of the genetic material from their parent plant. When they merge the offspring (usually seeds) have a genetic make up that's half from the male pollen and half from the female eggs.

Analysis of Sample Score Point 4 Response

Purpose: The candidate fulfills the purpose of the assignment by detailing two ways that flowering plants are pollinated (wind and insects) and explaining how plants inherit genetic material.

Subject Matter Knowledge: All of the subject matter knowledge demonstrated in the response is appropriate to the question asked. The pollination of flowering plants both by wind and by insects is described accurately and substantially, as is the process by which genetic material from male and female organs contribute to the makeup of the plant's offspring. The response demonstrates solid knowledge of life science by using several precise terms correctly: antennae, nectar, pistil, pollen grain, fertilization, parent plant, anther, and cross-pollination.

Support: The response is strengthened by the amount and high-quality of the details that are provided. To support the idea of wind pollination, for example, the candidate specifies the microscopic size, light weight, and abundance of pollen. To support the idea of insect pollination, the response explains how pollen is transferred from a flower, to the insect, to the next flower. Fertilization is also described precisely: "a grain of pollen . . . must land on the pistil for fertilization to take place. Pollen contains the male information that has to get to the eggs inside the pistil." All of this supportive detail further demonstrates the candidate's grasp of the relevant concepts and subject matter knowledge.

Rationale: The response is well-reasoned and comprehensive. Each part of the response is clear, accurate, logical, and easy to follow. The candidate provides reasons why wind pollination and insect pollination work, reasons why the pollen grain has to land on the pistil, and reasons why offspring inherit genetic characteristics from both parent plants.

Sample Score Point 3 Response

People or animals moving through the garden can brush against flowers just enough to cause pollination. As long as a grain of pollen from one plant shakes off and happens to land on another, pollination might occur. However, chances of pollination are better when birds, bees, and other insects get inside the flower and go after its nectar. A bird's beak or an insect's body will be covered in pollen after it drinks nectar. Some of the pollen that sticks to them gets left inside the next flower they visit, and some of that pollen is likely to land on the female part, resulting in pollination.

Pollen has to get from one plant to another for pollination. Pollen comes from the male parts of a plant. It has to get to the female parts of another plant. When that happens, the seed that results will have genes from each plant in it, male and female. One flower can make many seeds, all having genes from both parent plants. This is how genetic material is passed on from two different plants.

Analysis of Sample Score Point 3 Response

Purpose: The purpose of the assignment is largely achieved. The response is clearly focused on addressing each of the two parts of the assignment and provides some discussion of both pollination and the genetic makeup of plants.

Subject Matter Knowledge: The response demonstrates generally accurate subject matter knowledge. The candidate correctly identifies two different means of pollination—one that happens by chance and one that occurs as a result of the activity of insects and birds. A general understanding of how pollen moves from one flower to another is evident, including that pollinators seek out nectar, not pollen. However, the response does not demonstrate detailed knowledge of pollination, including flower anatomy. The second paragraph explains in general terms how genetic material in a seed is inherited from two parent plants, without explaining the process of fertilization.

Support: The supporting details are adequate. "Birds, bees, and other insects" are examples of pollinators but are not specific. For example, identifying hummingbirds as a kind of bird that drinks nectar would be stronger support, as would naming specific insects. The candidate uses the general terms "male parts" and "female parts" instead of more specific terms like "anther," "stigma," or "pistil."

Rationale: The response is adequately reasoned. In answer to the first bullet, the candidate chooses "chance" as a way plants are pollinated, and although wind is a better example of this type of pollination, humans and animals "brush[ing]" by is adequate. The candidate does understand, however, that birds and insects are the more likely vehicles of pollination. Reasoning about the way parent plants contribute to the genetic makeup of offspring is adequate.

Sample Score Point 2 Response

There are only two possible ways for plants to become pollinated: by wind or by rain. Some plants have pollen that is easily blown by the wind. Mostly it takes a pretty strong wind to send the pollen flying around. You can tell when it's windy enough for pollination because your car gets all greenish yellow from all the pollen that is blowing around. The pollen also settles on different plants when it lands, and fertilization occurs, especially if there was enough wind for a lot of pollen to get to each plant. The other way is by rain. The pollen is so light weight that it easily gets washed away by the rain and carried to other plants so they can be fertilized.

After the plant is fertilized, the seeds begin to form inside the plant, which in turn causes an offspring. In the making of an offspring much genetic information is passed on. For example, if you open an apple or a tomato or a bean pod there are seeds inside. Everything has seeds inside that are its offspring. An orange has seeds for other oranges and a dandelion has seeds for other dandelions. This is how plants reproduce themselves.

Analysis of Sample Score Point 2 Response

Purpose: The purpose of the assignment has been partially achieved. While the response generally focuses on pollination and the creation of offspring, the descriptions and explanations are incomplete. The first sentence, for example, states, "There are only two possible ways for plants to become pollinated: by wind or by rain." This declaration omits the role of bees, butterflies, bats, and birds, to name just a few other agents of pollination. The second paragraph contains no scientific description of how a plant's genetic makeup is determined.

Subject Matter Knowledge: The response reflects limited subject matter knowledge about pollination. Comments such as "The pollen also settles on different plants when it lands" lack critical specification about the conditions under which pollination is effective. The descriptions and explanations of pollination and fertilization are so general that the two terms seem to be used interchangeably, while the assignment requires clear understanding of the differences between these two processes. Similarly, the discussion of genetic makeup does not define a role for either the parent plants or for the male and female organs of a plant. Scientific terminology for and knowledge about plant reproduction is missing.

Support: The only reference to plant reproduction is "In the making of an offspring much genetic information is passed on." What is *the process by which* plant reproduction allows genetic material to be passed on? The examples of apple seeds and other seeds support the statement that "seeds begin to form inside the plant" after fertilization, but those examples do not shed any light on sexual reproduction in flowering plants or the role of each of the two parent plants.

Rationale: Both paragraphs of the response have discrete bits of information that indicate incomplete understanding. While it is true, for example, that wind is an important means by which plants become pollinated, it is not necessarily true that plants become fertilized as a result of having pollen land on them. Similarly, the fact that "Everything has seeds inside that are its offspring" indicates that seeds are critical to plant reproduction, but the issue of *how* they acquire the genetic traits of their parent plants has not been addressed.

Sample Score Point 1 Response

Flowering plants are pollinated in multiple ways. Two ways are by large numbers of plants and good fertilizer. A flowering plant will produce seeds. Once these seeds drop from the flower, they are carried away by birds, animals, and the wind. With the help of water and sunlight, the seeds will begin to grow. As the plant becomes fully mature, it can begin yielding seeds. Once seeds are produced the process of pollination will re-occur. New plants are the result of seeds which contain genes. You need a lot of plants to produce a large number of seeds and different new plants. Fertilizers make plants healthier and they will produce more seeds and bigger offspring, and more pollination will take place.

Analysis of Sample Score Point 1 Response

Purpose: The purpose of the assignment is not achieved in this response. The two types of pollination cited ("large numbers of plants and good fertilizer") are not ways plants are pollinated. "Genes" are mentioned, but there is no discussion of how parent plants contribute to the genetic makeup of their offspring other than genes being contained in seeds.

Subject Matter Knowledge: There is little accurate and appropriate subject matter knowledge demonstrated in the response. The description of a flower producing seeds, while simplistically correct, does not directly apply to the question asked. And the assertion that "[o]nce seeds are produced the process of pollination will re-occur" is inaccurate in suggesting that pollination begins after the production of seeds, rather than being the process by which seeds are produced. There is no subject matter knowledge in the response relevant to the process of pollination or the passing on of genetic material from parent plants to offspring.

Support: There is no relevant support for responding to the topic of pollination and genetic makeup.

Rationale: The response reflects no reasoning about the topic beyond a weak connection between the quantity and health of a plant and its ability to reproduce. The candidate does not demonstrate understanding of the process of pollination or how genetic material from parent plants contributes to the genetic makeup of their offspring.