Learning and Evaluation Situation

Science and Technology

Secondary I

Monstrous Selection

Adaptation and Natural Selection

Student Booklet

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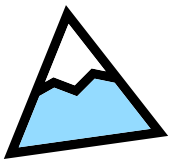
Grade:	Secondary I
Subject:	Science and Technology
Activity duration:	Three 75-minute periods
Materials:	One Student Booklet per student
Student's name:	
Teammate's name:	

Scenario

The year is 3024. You're a scientist who works in a lab creating new animal species—your very own monsters! Your expertise is choosing the right characteristics for your monsters to give them the best chance of survival. Your boss asks you and your colleague to create a new species of monster, taking the following aspects into account.

- Habitat
- Ecological niche
    - Occupied space
    - Diet
    - Period of activity (daily/seasonal rhythm)
- Physical and behavioural adaptations

You must provide your boss with a document that has all the information needed to create the monster.



Part 1: Describe the Habitat and Ecological Niche

Habitat

Habitat is a place where a species finds the conditions and resources it needs to survive.

1. Choose which of the following habitats your monster will live in. Important: Your monster's characteristics must be consistent with the habitat you choose.

Figure 1. *A fir forest*
A coniferous forest consisting mainly of fir trees.

Figure 2. *A coral reef*
An underwater habitat made up of coral.

Figure 3. *A grotto*
An underground cave that may or may not hold water.

Figure 4. *Lake Huron*
A freshwater lake that stretches between Canada and the United States.

Figure 5. *A cactus forest*
A forest found in arid locations, such as deserts.

Figure 6. *A swamp*
A very damp, densely vegetated environment with water-logged soil.

Figure 7. *A rocky cliff*
A steeply sloping, rocky escarpment caused by coastal erosion. Has little to no vegetation.

Figure 8. *Arctic pack ice*
A sheet of sea ice that forms on the surface of the Arctic Ocean.

Figure 9. *The seabed*
A cold, high-pressure habitat that is several hundred metres deep.

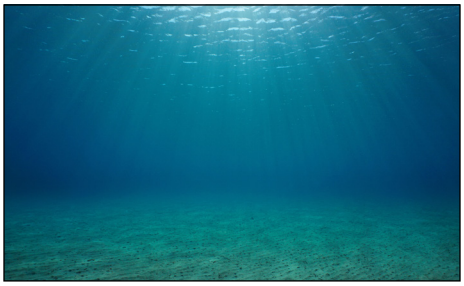


Figure 10. *A tree savanna*
A zone in the savanna where scattered trees and shrubs grow in a climate that is generally hot and dry.

Figure 11. *A basaltic plain*
A stretch of land covered with volcanic material (rock, ash, etc.). This type of soil is usually very fertile and allows vegetation to establish itself.

Figure 12. *The St. Lawrence River*
A North American river that stretches from the Great Lakes to the Atlantic Ocean. It has freshwater and saltwater zones.

2. Select and describe 3 factors from the following list.

- ☐ Describe the **climate** (temperature, rainfall, sunlight, etc.).
- ☐ Describe the **body of water** (freshwater, saltwater, current strength, temperature, etc.).
- ☐ Describe the **fauna** (prey used as food, potential predators, etc.).
- ☐ Describe the **flora** (plants used for food, shelter, etc.).
- ☐ Describe any proximity to **humans** (presence of buildings, cars, boats, noise, etc.).

DESCRIPTION OF YOUR MONSTER'S HABITAT
Factor 1:
Factor 2:
Factor 3:

Ecological Niche

The **ecological niche** is the specific role that a species fills in its ecosystem.
To avoid competition, no two species can have exactly the same ecological niche.

An ecological niche can be described according to its three main factors:

- Diet
- Occupied space
- Daily and seasonal rhythms

Diet

3. From the following list, place a check mark next to 2 or 3 foods that your monster eats.

☐ Leaves	☐ Insects	☐ Fish
☐ Herbs	☐ Rodents	☐ Other:
☐ Aquatic plants	☐ Birds	_____
☐ Nuts and seeds	☐ Plankton	
☐ Fruit	☐ Mollusks	

4. Is your monster a carnivore, herbivore, or omnivore?

☐ Carnivore	☐ Herbivore	☐ Omnivore

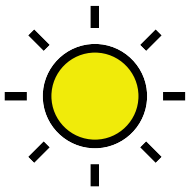
Occupied Space

5. Where exactly does your monster rest within its habitat?

_____

_____

Daily and Seasonal Rhythms



6. When is your monster active (eating, foraging, etc.)?

☐ Daytime (diurnal)	☐ At night (nocturnal)

7. Place a check mark next to the seasons during which your monster is active.

☐ Spring	☐ Fall
☐ Summer	☐ Winter

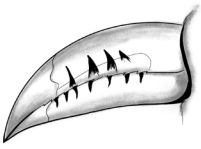
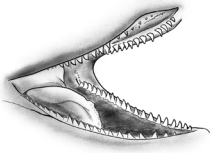
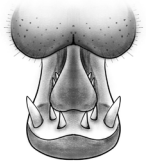
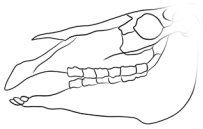
Part 2: Describe the Monster

Adaptations Related to Diet

1. Indicate how your monster gets its food. You can select one or more answers.

☐ Hunting
☐ Gathering
☐ Fishing
☐ Harvesting
☐ Filter feeding
☐ Grazing
☐ Insect predation
☐ Other: _____

2. From the following examples, circle the type of beak or teeth your monster has.

 Carnivore beak	 Insectivore beak	 Granivore beak (seed eater)	 Frugivore beak (fruit eater)	 Omnivorous filter feeding beak
 Teeth of an aquatic carnivore	 Teeth of an aquatic carnivore	 Mouth of an aquatic herbivore	 Mouth of an aquatic omnivorous filter feeder	 Teeth of an aquatic omnivore
 Teeth of a land carnivore	 Teeth of a land carnivore	 Teeth of a land herbivore	 Teeth of a land herbivore	 Teeth of a land omnivore

3. How are your monster's beak or teeth suited to its diet?

_____

_____

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Adaptations Related to Occupied Space

4. Select **1** option from the following list. Your monster has:

- ☐ A coat
- ☐ Plumage
- ☐ Scales

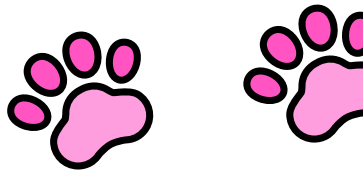
5. How do these elements suit the space your monster occupies (describe the colour, pattern, shape, etc.)?

_____

_____

6. Select **1** option from the following list. Your monster has:

- ☐ Wings
- ☐ Legs
- ☐ Fins
- ☐ Other: _____



7. How are these elements adapted to the space your monster occupies (describe the shape, size, presence or absence of claws, etc.)?

_____

_____

Seasonal Adaptations

8. Is your monster adapted to a cold, snowy winter (below 0°C)?

☐ Yes ☐ No

9. Which of your monster's characteristics are adapted to cold, snowy weather?

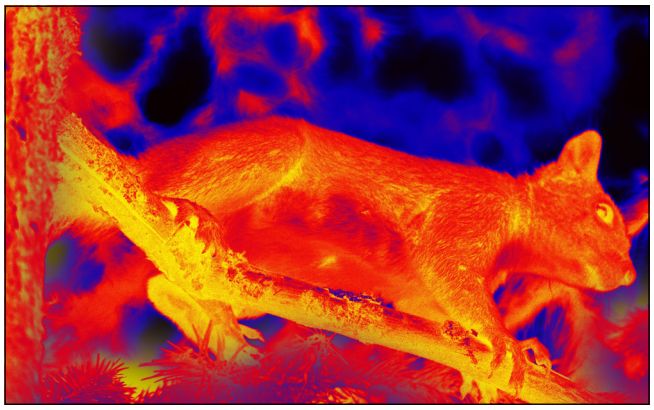
_____

_____

Part 3: Physical/Behavioural Adaptations and Natural Selection

Physical Adaptation

Physical adaptation is...

Example of Physical Adaptation in Plants	Example of Physical Adaptation in Animals
Monstera deliciosa has very large leaves to soak up the sun's rays. **Figure 13.** *Leaves of a* **Monstera deliciosa** 	The snake species *Vipera ammodytes* can see infrared light (heat), which enables it to spot prey in the dark. **Figure 14.** *A thermal image of a squirrel similar to what* **Vipera ammodytes** *might observe in the dark* 

1. Name **3** of your monster's characteristics that are physical adaptations.

Behavioural Adaptation

Behavioural adaptation is...

Example of Behavioural Adaptation in Plants	Example of Behavioural Adaptation in Animals
The sunflower (*Helianthus annuus*) moves to follow the path of the Sun in the sky. **Figure 15.** *Sunflower buds turned to face the Sun* 	The North American beaver (*Castor canadensis*) builds a dam to flood a small area, creating its own habitat. **Figure 16.** *A beaver and its dam* 

2. Name **2** of your monster's characteristics that are behavioural adaptations.

Natural Selection

Natural selection is...

Here are the main steps of the natural selection process.

1. Individuals within the same species have different physical or behavioural traits.
2. A disruptive event occurs.
3. Certain traits favour the survival of some individuals, and the least well adapted gradually die off.
4. Survivors reproduce and their favourable traits are passed on to their descendants.
5. Eventually, all of the descendants have these favourable traits.

3. Place the following events in chronological order:

   A. Giraffes that feed more easily have a better chance of surviving and passing on their traits to their descendants.
   B. Neck length is a physical trait that varies from giraffe to giraffe.
   C. Some giraffes with longer necks are able to feed on taller acacia leaves.
   D. Most giraffes have elongated necks.
   E. The lower leaves of acacias are becoming increasingly rare.

   Answer: _____ - _____ - _____ - _____ - _____

Part 4: Disruptive event

Your monster's habitat undergoes changes and becomes disrupted. Is your monster adapted to its new environment, or will it perish?

1. Here are three disruptive changes.
   Choose **1** that will disrupt your monster's habitat.

☐ **Event 1:** Frequent torrential rains	Torrential rains cause rivers to overflow their banks, flood surrounding land, erode the soil, and lead to landslides. They destabilize aquatic species, decimate vegetation, and even displace land-living species. In the short term, the abundant precipitation cools ambient air and surfaces.
☐ **Event 2:** Frequent periods of extreme heat	The increased frequency of extreme heat events reduces the amount of water available for plants and animals, and causes a reduction in vegetation. Frequent periods of extreme heat also increase the risk of forest fires. Air, ground, and water temperatures rise. Bodies of water become more acidic as dioxygen levels decrease, which has a direct impact on animal and plant species.
☐ **Event 3:** Proliferation of a species of insect pest	Insect pests attack several tree species. These insects eat the trees' leaves and weave webs around them. The trees become unavailable to other animal species, making the animals more vulnerable. The diseased trees destabilize the soil and encourage the proliferation of plant diseases. As forests are ravaged, soil and air temperatures rise.

Following the disruptive event...

2. Does your monster have at least 1 type of food available?

   ☐ Yes (Justify your answer, then go on to question 4)
   ☐ No (Go to question 3)

3. Do its beak or teeth allow it to eat other foods? Justify your answer.

4. Does your monster still have a place to rest? Justify your answer.

- ☐ Yes
- ☐ No

5. Can your monster continue its daily and/or seasonal activities? Justify your answer.

- ☐ Yes
- ☐ No

6. What aspects of your monster's ecological niche are still favourable in its new environment?

- ☐ Diet
- ☐ Occupied space
- ☐ Daily and seasonal rhythms
- ☐ None

7. Name one of your monster's physical traits or behaviours that is still adapted to its new environment.

   If there are none, go to question 8.

8. Name one of your monster's physical traits or behaviours that is detrimental to its survival in its new environment.

9. Based on questions 2 to 8, do you think your monster could survive in its new environment?

   ☐ Yes
   ☐ No

Justify your answer by referring to your monster's ecological niche (diet, occupied space, seasonal rhythm) and physical and behavioural adaptations.

10. Based on the principles of natural selection, explain how habitat disturbance can influence the community of monsters created by your classmates.