1.

Biologists are interested in preserving the diversity of living organisms on the planet.

(a) **Explain** THREE of the following processes or phenomena, using an appropriate example for each.

- mutation
- adaptive radiation
- polyploidy
- population bottlenecks
- growth of the human population

(b) For each process or phenomenon you selected in (a), **discuss** its impact on the diversity of life on Earth.

2.

Survival of organisms depends on adaptive behavior and species interactions.

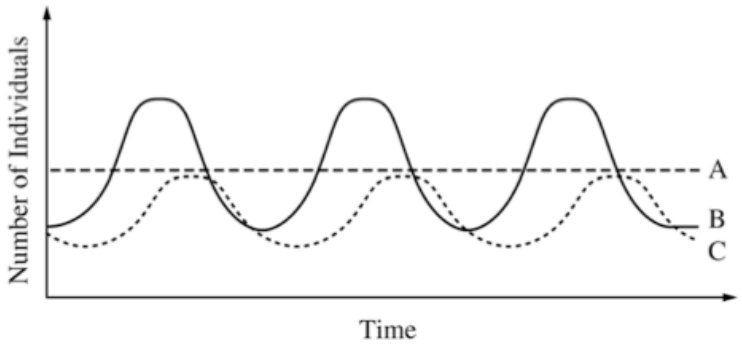
(a) Behaviors of organisms may be influenced by environmental factors. Select two of the following types of behavior. For each type, explain

(i) how the environment affects the behavior, and

(ii) why this behavior increases the survivorship of individuals of a species.

- Taxis/Kinesis
- Migration
- Courtship

(b) Interactions among populations may have an effect on densities of the species that interact. Predation represents an important interaction among populations. The curves below depict the population densities of three species: a small herbivore, a larger herbivore, and a carnivore.



Identify which curve represents which of the species listed, and **justify** your answer by describing the changes in the population densities of these three species over time.

3.

An experiment was conducted to measure the reaction rate of the human salivary enzyme α-amylase. Ten mL of a concentrated starch solution and 1.0 mL of α-amylase solution were placed in a test tube. The test tube was inverted several times to mix the solution and then incubated at 25°C. The amount of product (maltose) present was measured every 10 minutes for an hour. The results are given in the table below.

Time (minutes)	Maltose Concentration (μM)
0	0
10	5.1
20	8.6
30	10.4
40	11.1
50	11.2
60	11.5

(a) **Graph** the data on the axes provided and **calculate** the rate of the reaction for the time period 0 to 30 minutes.

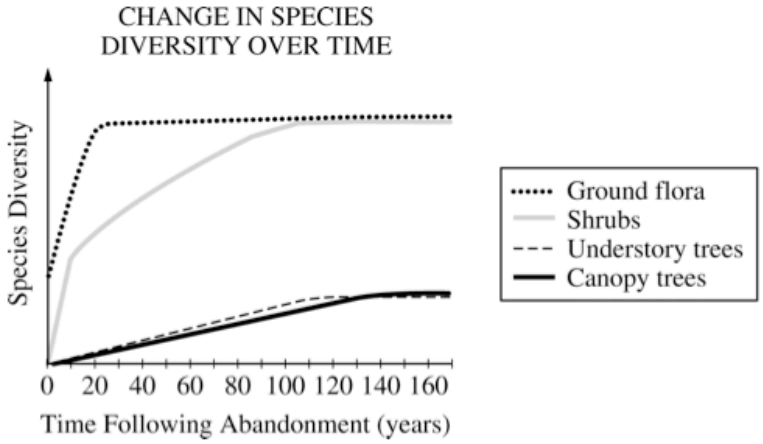
(b) **Explain** why a change in the reaction rate was observed after 30 minutes.

(c) **Draw** and **label** another line on the graph to predict the results if the concentration of α-amylase was doubled. **Explain** your predicted results.

(d) **Identify** TWO environmental factors that can change the rate of an enzyme-mediated reaction. **Discuss** how each of those two factors would affect the reaction rate of an enzyme.

4.

Ecological succession describes the pattern of changes in communities over time. The graph below shows changes in plant diversity following the abandonment of an agricultural field in a temperate biome.



(a) **Discuss** the differences in plant diversity shown in the graph and **explain** how the changes affect the animal species composition between years 0 and 120.

(b) **Identify** TWO biotic and TWO abiotic factors and **discuss** how each could influence the pattern of ecological succession.

(c) **Design** a controlled experiment to determine how the diversity of plant species in a newly abandoned field would be affected by large herbivores.