

**1.**

At the sound of shattering glass, people quickly turn their heads. **Discuss** how the human nervous system functions to produce this type of response to an external stimulus.

(c) At the sound of shattering glass, people quickly turn their heads. **Discuss** how the human nervous system functions to produce this type of response to an external stimulus. **(5 points)**

- **Stimulus/Intermediating Structure of Receptor Action (1 point)**  
Stimulus (sound waves, pressure, heat, etc.) producing an appropriate receptor action (eardrum vibrating, cochlear hairs vibrating or bending, pressure receptors firing, heat receptors firing, etc.)
- **Input/Sensory/Afferent (1 point)**  
Signal direction toward the central nervous system
- **Integration (1 point)**  
Processing/Interpretation by CNS  
Interneurons/Association/Communicating/Internuncial
- **Output/Motor/Efferent Response (1 point)**  
Signal direction toward effectors (peripheral NS) **or** description of the response or autonomic nervous response (e.g., increase in blood pressure or heart rate, muscle contraction **but not just** turning of head)
- **Possible Elaboration (1 point)**  
Neural electrophysiology (e.g., action potential, neurotransmitters, synapse)  
Neuron structure and impulse pathway  
Sensory physiology

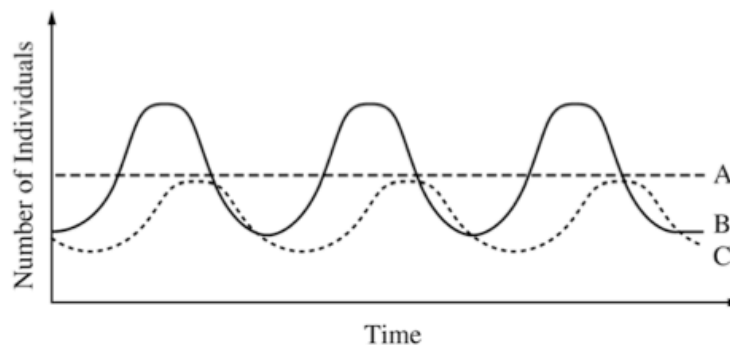
## 2.

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.

**Part (a)** (6 points maximum)

Answer must include at least one environmental point (*how*) and one survivorship point (*why*) to reach the 3-point maximum for each behavior.

Students were instructed to choose TWO types of behavior

**Taxis/Kinesis**

*How:* Identification of environmental stimulus/trigger (e.g., light, moisture, pH, nutrients, temperature)

*Why:* Adaptiveness of response (e.g., escape from predators, find food, avoid desiccation)

**Migration**

*How:* Identification of environmental stimulus/trigger (e.g., changes in light/dark cycle, nutrients, temperature, ecological changes/catastrophes)

*Why:* Adaptiveness of response (e.g., access to food, water, nutrients, temperature tolerance)

**Courtship**

*How:* Identification of environmental stimulus/trigger (e.g., changes in light/dark cycle, nutrients, temperature, ecological changes/catastrophes)

*Why:* Adaptiveness of response (e.g., mated pair has better access to food, water, nutrients, temperature tolerance) increasing survival of parents and/or offspring

**Part (b)** (2 points maximum per curve)

The justifications are required for any credit to be awarded.

"Large" and "small" assignments for herbivores are interchangeable if the appropriate justification is provided in the essay. Partial credit for stating that curve A is the predator was awarded in essays that stated the predator readily switched between large and small herbivores as its prey.

## Curve A

- large herbivore
- population not affected by predators in curve C
- food sources constantly available; eats different food than small herbivore

## Curve B

- small herbivore
- largest population size
- short generation time
- population decreases as predator increases

## Curve C

- predator
- smallest population size
- increase of predators follows increase of herbivores; increase of predators drives decrease of herbivores