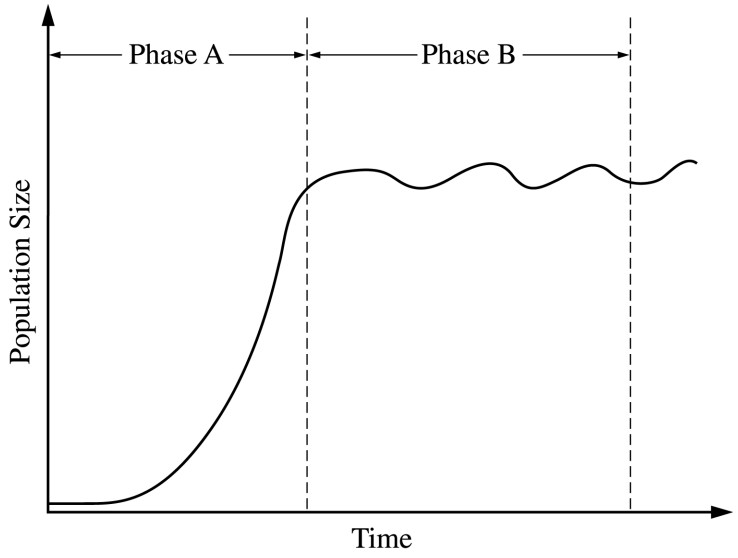
3. Many populations exhibit the following growth curve:



(a) Describe what is occurring in the population during phase A.

(b) Discuss **THREE** factors that might cause the fluctuations shown in phase B.

(c) Organisms demonstrate exponential (*r*) or logistic (*K*) reproductive strategies. Explain these two strategies and discuss how they affect population size over time.

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4. Death is a natural and necessary part of life cycles at all levels of organization.

(a) Discuss **TWO** examples of how cell death affects the development and functioning of a multicellular organism.

(b) Discuss **ONE** example of how substances are degraded and reused in cells.

(c) Discuss the evolutionary significance of death.

END OF EXAMINATION

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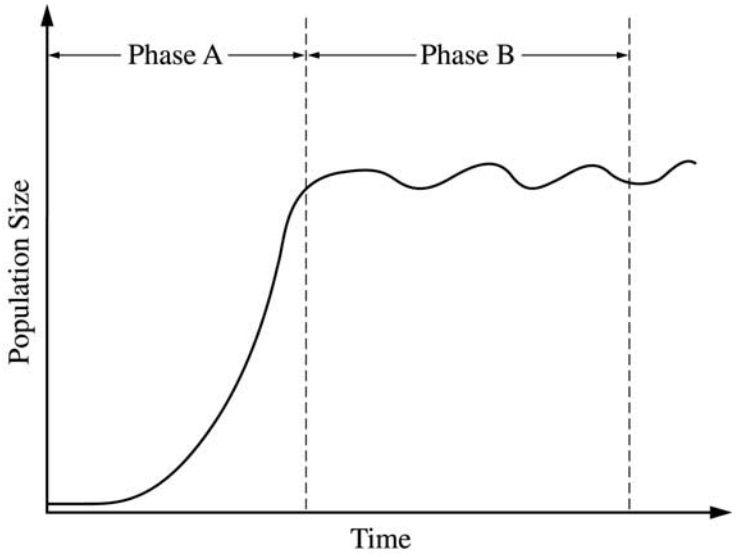
AP® BIOLOGY
2003 SCORING GUIDELINES

Question 3

Many populations exhibit the following growth curve:



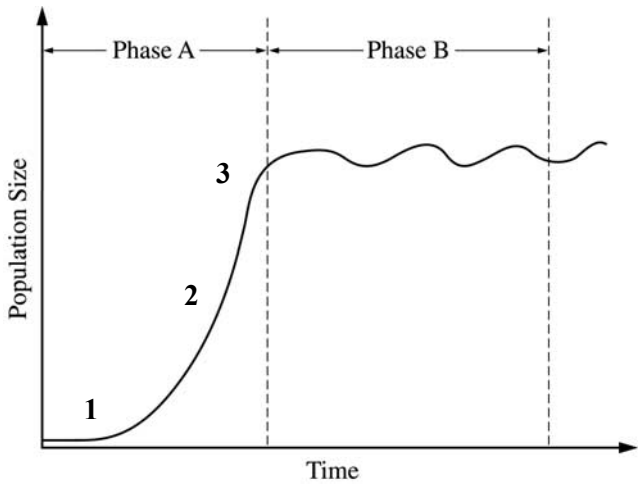
(a) Describe what is occurring in the population during phase A.

(b) Discuss **THREE** factors that might cause the fluctuations shown in phase B.

(c) Organisms demonstrate exponential (*r*) or logistic (*K*) reproductive strategies. Explain these two strategies and discuss how they affect population size over time.

****Global point; 1 point**: Carrying capacity definition: The number of individuals of a particular species that an environment can support; determined by the availability of resources. Point can be earned in any section.

(a) Maximum 3 points



1 point for each part of curve

#3 population growth slows as population approaches the carrying capacity; deceleration. No point for stating that population reaches carrying capacity — must indicate rate change (slows) or levels off.

#2 exponential growth; log phase; period of rapid growth; dramatically or rapidly increasing

#1 establishment period or lag phase: population grows slowly or does not grow. No credit for small population size, must indicate slow growth rate

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Question 3 (continued)

(b) Maximum 4 points

3 points: Three biologically sound factors that discuss the rise or fall of population size. Only the first three factors discussed will be scored. Commonly used density-dependent factors include limited resources, predation (predator/prey cycles), disease, and reproduction. Density-independent factors must reflect the periodic nature of the curve and cannot include cataclysmic events such as earthquakes, volcanoes, etc.

For each example to be legitimate, it must
- have a biologically sound explanation/discussion
- have a cause and an effect
- fit the graph in phase B

1 point for explanation of a complete cycle (rise and fall of population size.)

(c) Maximum 4 points

Explanation: 2 points (1 each for *r* and for *K*) Each explanation must have at least **two** characteristics from the table

***r*-strategists**	***K*-strategists**
Many young	Few young
Little energy investment in each	High energy investment in each
Small young	Large young
Rapid sexual maturation	Slow sexual maturation
Higher incidence of asexual reproduction	Higher incidence of sexual reproduction
Brief reproductive life span	Long reproductive life span
Little or no parental care	Lots of parental care
"Big bang" (semelparous) reproduction	Many reproductive events (iteroparous)
Unpredictable environment	Predictable environment
Population control by density-independent factors	Population control by density-dependent factors
Short life span	Long life span
Type III survivorship curve; few offspring survive	Type I survivorship curve; many offspring survive
Not prone to extinction	Prone to extinction
Higher reproductive capacity	Lower reproductive capacity

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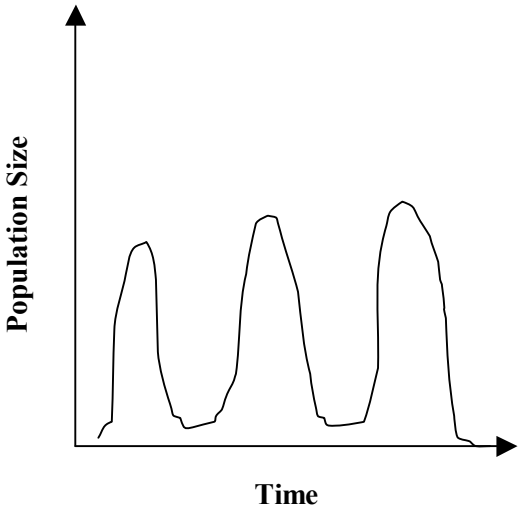
Question 3 (continued)

Discussion: 2 points (1 point each) Note: No points for a graph without an explanation

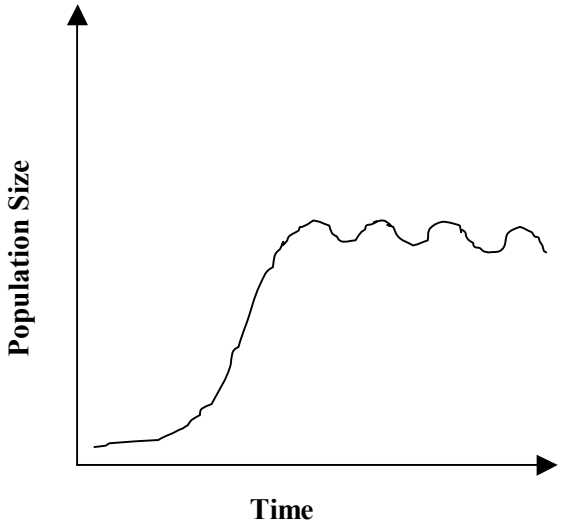
***r*-strategists**

boom/bust (great fluctuations) in population size



***K*-strategists**

population *stabilizes* around K (carrying capacity)



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