Use the following information to answer the next two questions.

Lactose intolerance is an autosomal recessive condition characterized by the inability to digest lactose. People who are either homozygous for the dominant allele or heterozygous are able to digest lactose. The frequency of lactose intolerance differs among populations. For example, 14% of northern Europeans have lactose intolerance.

—based on NCMHD Center of Excellence for Nutritional Genomics, 2009

The NCMHD Center of Excellence for Nutritional Genomics. 2009. Lactose intolerance. *Concepts in Nutrigenomics*. The NCMHD Center of Excellence for Nutritional Genomics. http://nutrigenomics.ucdavis.edu/?page=Information/Concepts_in_Nutrigenomics/Lactose_Intolerance.

Numerical Response

10. What is the frequency of the allele for lactose intolerance in the northern European population?

Answer: 0.37

0 | . | 3 | 7

(Record your answer **as a value between 0 and 1 rounded to two decimal places** in the numerical-response section on the answer sheet.)

$\sqrt{q^2} = aa = \sqrt{0.14}$

$q = 0.374...$

Use the following additional information to answer the next question.

> The frequency of the dominant allele associated with the ability to digest lactose has increased dramatically over time in the northern European population.

42. The dramatic increase in frequency over time of the dominant allele associated with the ability to digest lactose provides evidence of

A. evolution in the population, which resulted from the selective advantage provided by the dominant allele

B. evolution in the population, which resulted from the environmental resistance provided by the dominant allele

C. genetic equilibrium in the population, which resulted from the selective advantage provided by the dominant allele

D. genetic equilibrium in the population, which resulted from the environmental resistance provided by the dominant allele

If a population is in genetic equilibrium, p and q won't change.

Use the following information to answer the next question.

The Roma are a group of traditionally nomadic people who wandered in search of food, work, and places to camp. Genetic analysis indicates that the Roma people descended from populations in India and Pakistan. Three main groups of Roma presently live in Europe, each of which originated when a few individuals broke away from the parent population and formed new isolated communities.

43. The establishment of three isolated Roma populations in Europe illustrates

A. natural selection - selection of one trait over another
B. the founder effect
C. the bottleneck effect
D. ecological succession

founder effect - few ind. leave a population and start a new isolated pop.

bottleneck effect - pop. is dramatically reduced then repopulates - reduces genetic diversity

Use the following information to answer the next two questions.

To study the effect of grazing on biodiversity in a grassland community, scientists prevented sheep and rabbits from accessing a particular area of the grassland. They discovered that biodiversity decreased in areas where grazing did not occur because grazing prevents the most successful plant species from overtaking an area. When grazers consume successful plant species, some of the less successful plant species are given a chance to grow.

—based on *Nature*, 2005

Moore, Peter D. 2005. Parasite rattles diversity's cage. *Nature* 433, no. 7022 (January 13): 119.

44. Plant species that consistently remain in the grassland community where grazing is prevented are known as

A. seral species
B. climax species – dominant plant species that out competes others
C. pioneer species – first species that appear in succession
D. intermediate species

45. Grazing increases biodiversity in a grassland by decreasing the

A. gene flow of less successful plant species
B. genetic drift of more-successful plant species
C. interspecific competition for less successful plant species
D. interspecific competition for more-successful plant species

migration (immigration/emigration)

random/chance changes in gene pool

competition between diff. species

Use the following information to answer the next question.

Mountain pine beetles tunnel under the bark of pine trees and lay eggs, which hatch into larvae. The larvae feed on the trees, a process that severely damages but does not kill the trees. Mountain pine beetles often carry and distribute spores from bluestain fungus. The presence of the bluestain fungus helps the beetles invade a tree. The bluestain fungus eventually kills the pine trees.

46. Which of the following rows identifies the relationship between a mountain pine beetle and a bluestain fungus and the relationship between a mountain pine beetle and a pine tree?

Row	Mountain Pine Beetle and Bluestain Fungus	Mountain Pine Beetle and Pine Tree
A.	~~Commensalism~~	Predation
B.	~~Commensalism~~	Parasitism
C.	Mutualism	~~Predation~~
D.	Mutualism	Parasitism

Predation - one species kills/eats another

Symbiosis

Commensalism - One species benefits /other neither benefit or harmed

Mutualism - both species benefit

Parasitism - one benefits other is harmed

Use the following information to answer the next question.

> Northern pike are fish that were introduced into the south-central area of Alaska in the 1950s by a fisherman. Scientists believe that increasing numbers of northern pike are reducing populations of salmon in this region. Northern pike eat large numbers of young salmon before the salmon leave to mature in the ocean.
>
> —based on *Nature*, 2002
>
> Dalton, Rex. 2002. Pike pests ravage Alaska's salmon. *Nature* 418, no. 6901 (August 29): 907.

47. Scientists believe that the decrease in the salmon population in south-central Alaska is caused by northern pike

A. ~~emigration~~, which causes a decrease in salmon mortality
B. ~~emigration~~, which causes an increase in salmon mortality
C. immigration, which causes a ~~decrease~~ in salmon mortality
D. immigration, which causes an increase in salmon mortality

4 factors affecting pop. growth

emigration – leaving a pop. (-)
immigration – entering a pop (+)
mortality – death (-)
natality – birth (+)

Use the following information to answer the next question.

In 1957, French scientists transported two wild Corsican mouflon sheep to Haute Island, which has an area of 6 km^2 and is located midway between Africa and Antarctica. By 1977, the flock had grown to 700 sheep.

—based on Kaeuffer et al., 2007

Kaeuffer, Renaud, David W. Coltman, Jean-Louis Chapuis, Dominique Pontier, and Denis Réale. 2007. Unexpected heterozygosity in an island mouflon population founded by a single pair of individuals. *Proceedings of the Royal Society B* 274 (February 22): 527–33.

Numerical Response

11. What was the density of the wild Corsican mouflon sheep population on Haute Island in 1977?

Answer: 117 **sheep/km^2**

(Record your answer **as a whole number** in the numerical-response section on the answer sheet.)

$D_p = \frac{N}{A} = \frac{700 \text{ sheep}}{6 \text{ km}^2} = 116.66\ldots \text{ sheep/km}^2$

Use the following information to answer the next question.

The woodland caribou, *Rangifer tarandus*, has been declared a species at risk. In 1982, there were an estimated 193 260 woodland caribou in Canada. By 2002, the population had declined to an estimated 188 850.

—based on Environment Canada, 2003

Environment Canada. 2003. Woodland Caribou. *Species at Risk*. Environment Canada, www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm (accessed August 15, 2003).

Numerical Response

12. What was the per capita growth rate of the woodland caribou population between 1982 and 2002?

Answer: – 0.02

(Record your answer **as a value between 0 and 1 rounded to two decimal places** in the numerical-response section on the answer sheet.)

$cgr = \frac{\Delta N}{N} = \frac{\text{change in pop}}{\text{initial pop.}} = \frac{4410 \text{ caribou}}{193260 \text{ caribou}}$

$= 0.0228\ldots$

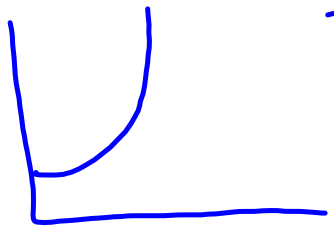
Use the following information to answer the next question.

Red lionfish are native to the waters of the southern Pacific Ocean, the Indian Ocean, and the Red Sea. Approximately five times per month, female red lionfish release more than 1 000 eggs at one time into the water, where fertilization takes place. Within a day, the fertilized eggs hatch into larvae, which then migrate to the ocean floor.

48. The expected growth pattern and growth curve of the red lionfish population in the southern Pacific Ocean are, respectively,

A. exponential and S-shaped
B. exponential and J-shaped
C. logistic and S-shaped
D. logistic and J-shaped

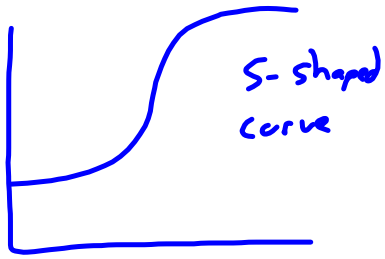
exponential growth



J-shape curve

- typical of r-selected species

logistic growth



S-shaped curve

typical of k-selected species