

**BIOLOGY 1M03 - Test 2 Evening (Version 2)**

**MULTIPLE CHOICE.** Choose the one option that best completes the statement or answers the question. There is only one fully correct answer for each question. There is no penalty for guessing. There are no partial marks, each question is worth 1 mark.

**DR. KAJIURA'S MULTIPLE CHOICE QUESTIONS 1- 18**

- 1) Consider several populations of humans. They are of equal size and net reproductive rates, but are different in age structure. The population which is most likely to increase during the next thirty years is the population with the greatest proportion of individuals in which age range?
- A) 20 to 30 years  
B) 50 to 60 years  
✓ C) 10 to 20 years — *pre-reproductive*  
D) 40 to 50 years  
E) 30 to 40 years
- 2) Ecologists utilize mathematical models and computer simulations because:
- ~~A) most are mathematicians~~  
~~B) ecology is a very descriptive science~~  
~~C) most ecological experiments are too broad in scope to be performed~~  
~~D) variables can be manipulated with computers, but not in field experiments~~  
✓ E) these approaches allow them to study the interactions of multiple variables and simulate large scale experiments
- 3) A population's growth rate will not increase if which of the following occurs (all else remains the same)?
- ~~A) decreased doubling time~~  
✓ B) lower frequency of reproduction  
C) greater reproductive lifespan  
~~D) greater number of offspring produced per individual~~  
E) earlier age at which individuals first reproduce
- $$\frac{dn}{dt} = rN$$
  
*equal fecundity,  $r$  of A*
- 4) Brandon and his lab partner, Matthew, have recently joined the Hamilton Naturalists Club. During a field trip to a local meadow, they assisted a researcher who is studying populations of crickets. If Brandon and his lab partner determine that there are one hundred and fifty-two crickets per square kilometer in the meadow, what does that measure with regards to the cricket's population?
- A) it measures the population's clustered range  
B) it measures the population's dispersion pattern  
C) it measures the population's biome shared with the birds of its diverse microhabitat  
✓ D) it measures the populations's resource allocation  
E) it measures the population's density
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- 5) The ecological study that focuses primarily the components controlling the exchanges of materials, energy, and organisms across several ecosystems is called \_\_\_\_\_, whereas the effort to preserve and restore threatened populations, communities, and ecosystems is referred to as \_\_\_\_\_.
- A) ecosystem ecology, conservation biology  
B) community ecology, conservation biology  
✓ C) landscape ecology, conservation biology  
D) integrative ecology, population ecology  
E) ecosystem ecology, global ecology

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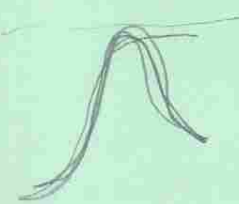
- 6) An introduced species is termed "invasive" if:
- A) it is a threat to humans
  - B) it survives in its new habitat and forms mutualistic relationships with other native species
  - C) it cannot successfully maintain a population in a novel habitat
  - ☒ D) it outcompetes native species in its new habitat
  - E) it does not cause significant harm to native species
- 7) A Biology 1M03 student obtains a research position. She is assigned to monitor populations of fish. In order to maintain the largest sustainable fish harvest, fishing efforts should:
- A) reduce the population to very low numbers to take advantage of exponential growth
  - B) take only post-reproductive fish
  - C) maintain the population above its carrying capacity
  - ☒ D) maintain the population density close to  $\frac{1}{2} K$
  - E) both A and B
- 8) Uniform dispersion patterns are generally associated with:
- A) patterns of elevated humidity
  - B) chance distributions
  - ☒ C) competitive interactions among members of the population
  - D) nutrients concentrated within the range of the population
  - E) the random distribution of seeds via birds
- 9) A survivorship curve that involves producing high numbers of offspring which have a low probability of surviving to adulthood is characteristic of:
- A) humans
  - B) whales
  - C) dogs
  - ☒ D) hydra
  - E) oysters
- 10) Which of the following assumptions have to be made regarding the mark-recapture estimate of population size?
- i) The marked individuals have mixed thoroughly with the population after being marked
  - ii) Unmarked individuals have the same probability of being trapped as marked individuals
  - iii) No new individuals have entered the population by immigration
- A) ii only
  - B) ii and iii only
  - ☒ C) i only
  - D) i, ii and iii
  - E) i and ii only
- 11) Which of the following best describes the field of study called global ecology?
- ☒ A) it studies the flow of materials and energy between biotic components and abiotic components of an ecosystem
  - B) it studies the factors regulating the exchanges of materials, energy, and organisms among ecosystems
  - C) it studies the interactions between different species which live in an ecosystem
  - ☒ D) it studies how the regional exchanges of energy and materials influences the distribution and functioning of individuals across the biosphere
  - E) it studies which factors affect the size and structure of a population over time

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- 12) Which of the following populations would grow the fastest, if you assume that all other factors are the same?
- A) Animal that reproduces two times a year starting at age seven
  - B) Animal that reproduces one time a year starting at age five -
  - ☒ C) Animal that reproduces one time a year starting at age six
  - ☒ D) Animal that reproduces two times a year starting at age five -
  - E) Animal that reproduces one time a year starting at age seven
- 13) Gorillas are classified as primates. These majestic animals have relatively low birth rates. They take very good care of their offspring. Most gorillas live a long life, if they are protected from illegal poachers, who attempt to hunt them. Fortunately, gorillas living in a protected zoned reserve will display which of the following survivorship curves?
- A) A line that dips downwards initially, and then sharply flattens out
  - B) A horizontal line that slopes gradually in an upward direction
  - ☒ C) A line that remains horizontal
  - ☒ D) A relatively flat line that drops steeply towards the end
  - E) Both A and B
- 14) Based on the data shown in the table below, what type of population growth curve did this gypsy moth population follow from 1990 to 1998?

Year	Density (moths/square meter)
1983	0.0
1990	0.5
1994	8
1996	55
1998	578
2000	250
2002	220



- A) Logistic curve
- ☒ B) Sigmoidal curve
- ☒ C) Exponential curve
- D) Stochastic curve
- E) Both B and D

15) Three Biology 1M03 students conducted a tutorial experiment, which investigated the growth of *Periplaneta Americana* cockroach populations over the academic term. Initially, the cockroach population increased dramatically. Later on, growth reduced and the population size leveled off. While food, which consisted of ground food pellets and sugar was still abundant, the three students observed that the cockroaches started eating their own eggs (cannibalism) when its population densities were elevated. Given that the students have excellent knowledge in population ecology, what will they conclude about the cannibalistic activities of cockroaches?

- ☒ A) It serves as a density-independent means of population control
- ☒ B) It is not adaptive since populations generally do the best when their numbers are elevated
- ☒ C) It has no effect on the population's growth because food is the limiting factor
- ☒ D) It serves as a density-dependent means of population control
- ☐ E) Both B and C

↑ density, cannibalism, food high

16) Animals that occur in a random dispersion pattern include:

- ☒ A) Invertebrates that live in a lake that has equal resources throughout
- ☒ B) Ants that form social groups
- ☒ C) Flocks of sea gulls, which forage for food together
- ☒ D) Tawny owls, that occupy very well defined territories
- ☒ E) Tigers, when they are searching for female mates

17) Which of the following is the most likely reason why the brown tree snake is not as abundant in its native geographic range as it is on Guam?

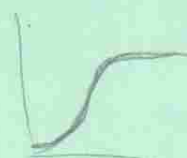
- ☒ A) There are very few adequate prey present for the snake to eat in its native geographic range
- ☒ B) In its native geographic range, competition and predation limits its population growth
- ☒ C) In its native range, the brown tree snake's emigration exceeds its birth rates
- ☒ D) The survivorship curve of the brown tree snake mostly likely differs between geographic ranges
- ☒ E) The biotic potential of the brown tree snake differs between its native geographic range and Guam

18) In the logistic growth model, as population size increases, birth rates:

- ☒ A) And death rates remain steady
- ☒ B) Rates decline and /or death rates increase
- ☒ C) Remain constant and death rates increase
- ☒ D) And death rates increase
- ☒ E) Decline but death rates remain steady

$$\frac{dN}{dt} = (b-d) N \left(1 - \frac{N}{K}\right)$$

- more competition  
- less resources



### DR. QUINN'S MULTIPLE CHOICE QUESTIONS 19 - 30

19) The transition from hominoid to hominin occurred during a transition

- ☒ A) From forest to savanna
- ☒ B) From savanna to forest
- ☒ C) From arboreality to terrestriality
- ☒ D) A and C only

20) Bipedalism in hominins may have evolved, in part, because;

- ☒ A) Hominin ancestors were above-branch quadrupeds
- ☒ B) Hominin ancestors were below-branch, suspensory primates
- ☒ C) Hominin ancestors were vertical clingers and leapers
- ☒ D) Hominin ancestors were amphibians

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## BIOLOGY 1M03 - Test 2 Evening (Version 2)

21) \_\_\_\_\_ foods come from things that do not move but are protected in some way.

- A) Hunted
- ☒ B) Extracted
- C) Collected
- ☒ D) All of the above

22) Among contemporary early human foragers

- ☒ A) Food sharing and hunting are closely linked
- B) Only vegetable matter is shared
- ☒ C) All types of food are shared
- D) Almost no food is shared

23) Dependence on meat by ancestral humans may facilitate

- ☒ A) Food sharing
- ☒ B) Sexual division of labour
- ☒ C) The maintenance of home bases
- ☒ D) All of the above

24) The difference in gene expression between humans and chimpanzees is greatest in:

- A) Blood cells
- B) Liver cells
- ☒ C) Brain cells
- D) A and B only

25) \_\_\_\_\_, do not produce any change in the amino acid sequence of a protein.

- A) Transposable elements
- ☒ B) Synonymous substitutions
- ☒ C) Microsatellite loci
- D) Highly accelerated regions

26) The mtDNA and Y chromosome evidence from humans favours

- A) the viewpoint that modern humans evolved in areas of the Old World
- ☒ B) the viewpoint that modern humans evolved in Africa
- ☒ C) the viewpoint that African populations of modern humans interbred with archaic populations in Europe and Asia
- D) none of the above

27) Certain defects and disorders, such as Specific Language Impairment (SLI), are thought to be caused by a single gene. This shows that

- ☒ A) a single gene can be responsible for all of the machinery required for complex traits
  - ☒ B) a single gene, if broken, can disrupt the machinery required for complex traits
  - C) multiple genes conspire to sabotage complex traits
  - D) none of the above
- ] same ??

28) The evolution of lactase persistence in Africa and Europe was the result of;

- ☒ A) Convergent adaptation →
  - B) Drift acting on isolated populations
  - C) Gene flow between Africans and Europeans → milk
  - ☒ D) B and C only
- Same environment and evolved similar traits to drink milk

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29) Evolutionary psychologists believe the human mind evolved to solve the challenges that confront food foragers because

- ☒ A) Foraging is more time-consuming than agriculture
- ☒ B) Humans have practiced foraging for most of our evolutionary history
- ☒ C) Sexual division of labour is clearly evident in the fossil record
- ☒ D) All of the above

30) Incest prohibitions;

- ☒ A) Exist in almost all societies for brothers and sisters
- ☒ B) Are variable for distant kin
- ☒ C) Do not always conform to genetic categories
- ☒ D) All of the above

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PLEASE COMPLETE THE FOLLOWING QUESTIONS IN BLUE OR BLACK PEN.  
ANSWERS WRITTEN IN PENCIL WILL NOT BE RE-GRADED.  
 DO NOT USE CORRECTION FLUID OR CORRECTION TAPE.

DR. KAJIURA'S WRITTEN ANSWER QUESTIONS.

- 31) Imagine that you are working in the Department of Biology in a laboratory that specializes in population ecology. The population that you are studying has the following characteristics: the population's size is currently 675 individuals; the carrying capacity for the population is 735 and  $r = 0.01$ . What is  $dN/dt$ ? Show the complete formula, indicate all of the variables, and display your complete calculations. (4 marks)

$$N = 675 \text{ (current pop.)}$$

$$K = 735 \text{ (carrying capacity)}$$

$$r_{\max} = 0.01 \text{ (intrinsic growth rate)}$$

$$\frac{dN}{dt} = r_{\max} N \left( \frac{K - N}{K} \right)$$

$$= (0.01)(675) \left( \frac{735 - 675}{735} \right)$$

$$= 0.55$$

$\therefore$  The change in population over time  $\left( \frac{dN}{dt} \right)$  is <sup>about</sup> 0.55 individuals

- 32) In a mark – recapture study, a Biology 1M03 student traps, marks, and releases 152 turtles. After 2 days, 152 turtles are collected. 78 turtles were found marked in the second catch. What is her estimate of the population of turtles in that pond? Show the mark – recapture formula, identify all of the variables and display your complete calculations. State the estimated turtle population size. (4 marks)

$$\text{1st catch} = 152 \text{ turtles}$$

$$\text{total 2nd catch (marked + unmarked)} = 152 \text{ turtles}$$

$$\text{total marked in 2nd catch} = 78 \text{ turtles}$$

$$\text{estimated population size} = \frac{\text{Number of individuals in the first catch} \times \text{Total number of individuals recaptured (marked and unmarked) in the second catch}}{\text{Number of individuals marked in the recapture or second catch}}$$

$$= \frac{152 \times 152}{78}$$

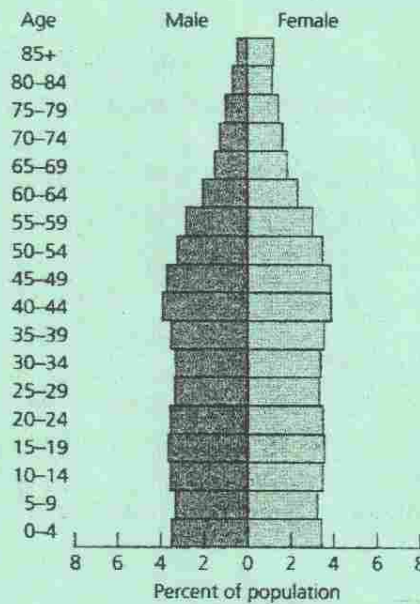
$$= 296$$

$\therefore$  The estimated population size is 296 turtles

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33) For the following age structure pyramid, describe the type of country it represents and elaborate upon the characteristics of that nation. (2 marks)



slow growing population  
 This age pyramid represents developed countries like the US or Sweden where the population growth is  $\frac{1}{2}$  slow. The population is relatively constant as there are relatively equal number of individuals in  $\frac{1}{2}$  each age group and the pre-reproductive to adult age group (0-55). Also the sex ratio is  $\frac{1}{2}$  about 1:1 meaning for every male there is 1 female. Also there are more surviving females than males as they reach 60 and above. These developed countries have good healthcare and technology that allow people to live to a long lifespan as seen in the pyramid, people live to 85+. Also the fecundity is relatively low because the modern medicine and healthcare allow people to live for long periods of time.

2



DO NOT INCLUDE INFORMATION THAT IS IRRELEVANT TO THE QUESTIONDR. QUINN'S WRITTEN ANSWER QUESTION

- 34) The risk of failure when relying on hunting for meat is thought to explain food sharing in our ancestors. Are the requirements for reciprocal altruism met in our hunter/gatherer ancestors that were living in small villages? Explain how food sharing helps reduce risks and illustrate numerically how the risk would be minimized (assume that a person can live for 10 days without meat and that chances of hunting success are 20% per day of hunting). Assume that the meat is sufficient to share with up to 5 other hunters (and families). (5 marks)

The requirements for reciprocal altruism is met in our hunter/gatherer ancestors living in small villages as reciprocal behavior allowed our ancestors to share food & protect themselves and select favored this cooperative behavior to reduce the risk of starvation since hunting is risky business as sometimes, some ~~with~~ hunters may not catch anything and the fruits gathered by the females are usually not enough to sustain both themselves and their male partner. Food sharing helps reduce risk by decreasing the chance of starvation for individuals.

→ If the chance of hunting success is 0.2  
The risk of starving is 0.8

Over the course of 10 days, there is a  $0.8^{10} = 0.1$  or  $1/10$  chance of starving  
~~which can lead to~~

→ If the meat is shared with 5 other hunters

The risk of starving is distributed among 5 hunters and the chance of hunting success is also shared among 5 hunters

∴ Risk of starving for the 5 hunters is  $0.8^5 = 0.33$

Over the course of 10 days, there is a  $0.33^{10} = 1.43 \times 10^{-4}$  chance of starving (about  $1/1000$  chance)

As a result, food sharing ~~is~~ ~~decreasing~~ decreases chance of starving by ~~increasing~~ because if 1 hunter fails to ~~get~~ hunt meat, there are 4 others to backup and the chance that all 5 fails to hunt for meat is very low so ~~starving~~ chance of starving is minimal and risk of hunting is reduced.

THE END