Biology 331: Ecology
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PART I

For each of the following matching questions, write the letter corresponding to the correct answer right next to each question. There is only one correct answer for each question. Any of the answers may be used more than once or not at all. Below is an example illustrating how to handle matching questions.

EXAMPLE:
The following choices apply to the next three questions. Use the best of the following choices as responses.

A. Cairo
B. Amman
C. Beirut
D. B and C
E. All of the above

- The capital of an African country A
- The capital of an Asian country D
- The capital of Egypt A

Please note that some choices (choice A for example) has been used twice, while others (choices B, C and E) have not been used at all; each question has only one correct answer; the letter corresponding to the correct answer has been written right next to each question.

The following choices apply to the next four questions. Use the best of the following choices as responses.

A. Density
B. Atmospheric pressure
C. Temperature
D. Both A and B
E. Both A and C
F. A, B and C

- Weight (force) per unit area of a column of air
- Higher at sea level than at the top of the world's highest mountain
- Directly influenced by gravity, which pulls the gas molecules in the atmosphere towards the earth's surface
- The atmosphere is divided into spherical layers based on changes in this.

The following choices apply to the next four questions. Use the best of the following choices as responses.

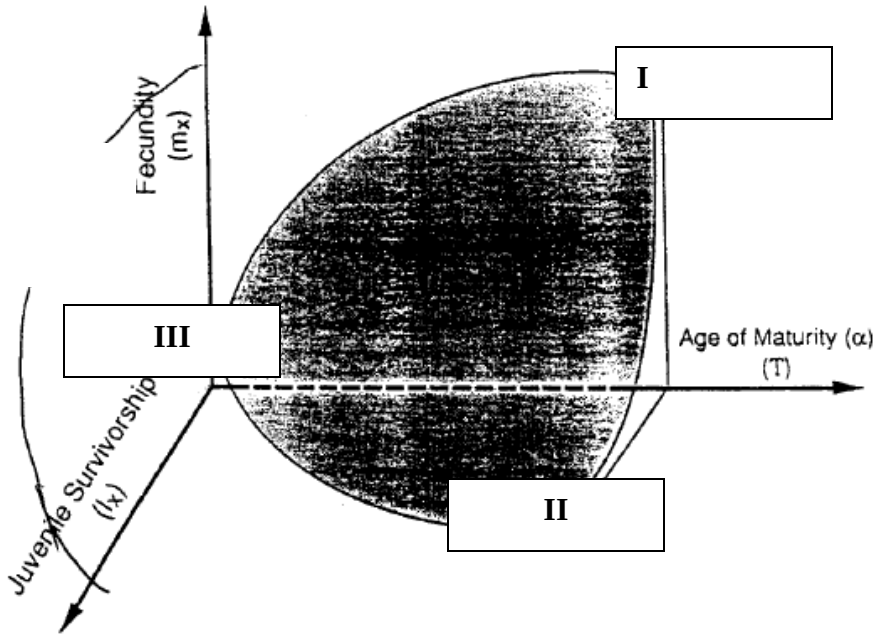
A. Troposphere
B. Mesosphere
C. Thermosphere
D. Both A and B
E. Both B and C
F. A, B and C

- This layer of the atmosphere is the furthest from the surface of earth.
- This atmospheric layer contains 75% of the mass of earth's air.
- In this layer, as altitude (distance from earth) increases, temperature decreases.
- The stratosphere is very similar in composition to this layer, except that this layer has more water and less ozone.

The following choices apply to the next two questions. Use the best of the following choices as responses.

A. Non-random mating
B. Gene flow
C. Mutation
D. Infinitely large population size
E. Natural selection

- Which must occur for a population to remain at Hardy-Weinberg equilibrium?
- Which can result when individuals migrate into a population?



Modified from Winemiller and Rose (1992)

The following choices apply to the next five questions pertaining to the above diagram, in which I, II and III represent three different fish life-history strategies. Use the best of the following choices as responses.

A. I only
B. II only
C. III only
D. More than one of the above

- Characterized by high age at reproductive maturity
- Characterized by high juvenile survivorship
- Characterized by low juvenile survivorship, low fecundity and low age at reproductive maturity
- Periodic life-history strategy
- Opportunistic life-history strategy

PART II

In the space provided next to each of the following phrases or statements, write the number, term or concept referred or alluded to by that phrase or statement.

An educated guess that a scientist poses to explain an observed phenomenon
……

This is the region where the trade winds meet. It migrates towards regions of the globe with the warmest surface temperature.
……

An explanation invoking an evolutionary reason for an adaptation
.....

This level in the hierarchy of ecological organization refers to a natural unit of living and non-living parts interacting to produce a stable system.
……

While ecology is a science, this is a concern. ……

He coined the term “ecology” from the Greek word *oikos* meaning house or place to live. ……

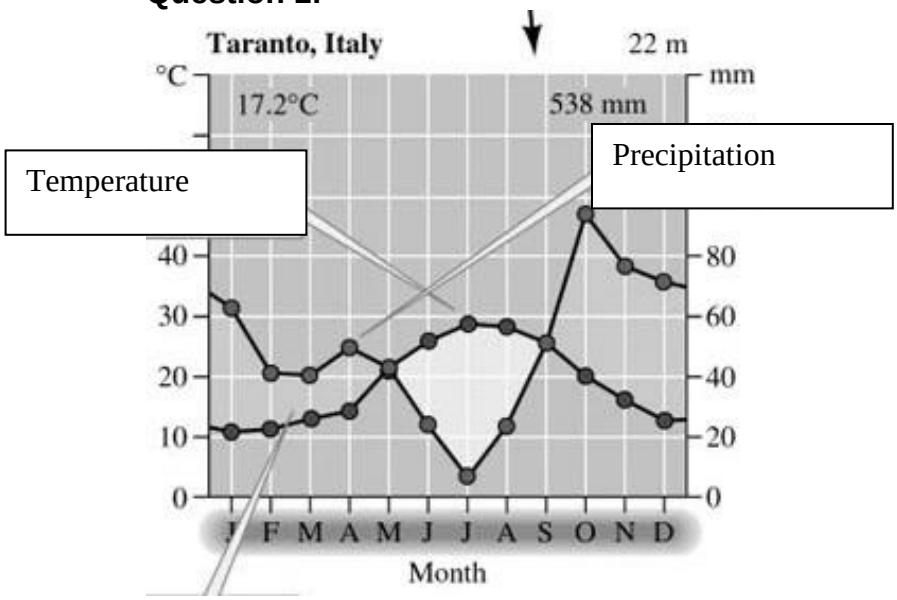
This branch of biology addresses environmental relationships ranging from individual organisms to factors influencing the state of the entire biosphere.
……

The number of circulation cells in the Southern Hemisphere
……

These winds blow from the east at high latitudes in the Northern Hemisphere.
……

This term refers to the sum total of processes that break down rocks and minerals, changing large particles into small particles.
……

PART IV
Question 1:



What does each of the following numbers in the climate diagram represent?

17.2 ^{o}C	
538 mm	
22 m	

Based on the above climate diagram, predict the weather of a typical December day in Taranto, Italy. Would you take an umbrella with you if you travel to Taranto in December? Would you necessarily need it?

Question 2:
An evolutionary ecologist tagged seven female house sparrows in a population and recorded the following data.

Year	Variable	Female Band Number						
		A	B	C	D	E	F	G
1999	Number of eggs laid	8	5	4	5	7	6	7
	Number of young born	5	1	3	4	2	4	3
2000	Number of eggs laid	5	6	4	5	7	7	9
	Number of young born	4	2	3	5	3	3	0
2001	Number of eggs laid	6	10	5	5	8	10	10
	Number of young born	4	8	5	4	6	8	9
2002	Number of eggs laid	6	6	3	5	7	8	10
	Number of young born	2	5	3	5	3	4	4

a. Calculate the fitness of female G. What assumptions did you make in order to be able to calculate its fitness? Would the fitness of this female be different if the seven females chosen by the ecologist were related? Explain your answer fully.

b. Rank the fitness of the seven female sparrows.

c. What data might you collect to improve on this measure of fitness for these birds?

Question 3:
Consider the following blood group data collected from a population at Hardy – Weinberg equilibrium with respect to the alleles responsible for different blood factors. All individuals in the population possess two different blood factors, each coded for by a two alleles. For the first blood factor, allele R is dominant to allele r. For the second blood factor, allele F is dominant to allele f. The frequencies observed for blood type in the population are as follows:

Blood Type (Phenotype)	Frequency
RF	0.60
Rf	0.15
rF	0.24
rf	0.01

1. Determine the frequency of the alleles r and F in the population.

2. Given the information above, all of the following statements concerning this population are true **EXCEPT**

- there is no mutation among the blood factor alleles.
- there is significant migration between this population and other populations.
- the population is large in size.
- there is no positive selection for the allele R.
- mating is random.