Please Attempt ALL of the Questions in This Section.

Matching**: Write the letter corresponding to the correct objective from the list at right for each space below:**

#1. Objectives of All of Unit 3 - Ecological Systems of Life

(1) _____

(2) _____

2 pts

#2. Objectives of Individual Ecology (Physiological + Behavioral Ecology)

(1) _____

(2) _____

2 pts

#3. Objectives of Population Ecology

(1) _____

(2) _____

2 pts

#4. Objectives of Community Ecology

(1) _____

(2) _____

2 pts

#5. Objectives of Ecosystems Ecology

(1) _____

(2) _____

2 pts

A To understand how all of the population interactions with their biological * physical environments (air, soil, water) cause evolutionary change by natural selection

B To understand the dynamics of evolutionary change among all interacting populations due to the forces of natural selection they impose

C To understand the dynamics of population size

D To improve your understanding of the process of biological inquiry which is the scientific method

E To understand the dynamics of population size of all of the interacting populations

F To understand how all of the populations interact with each other and with their physical environments (air, soil, water) to create ecosystem structure/ function

G To understand how physical, biological, and evolutionary processes affect individual organisms and their populations and communities that in turn affect ecosystem structure and function

H To improve your biological literacy

I To understand how organisms respond adaptively to their total environment (biophysical, resource, social/ reproductive, predation/ parasitism, mutualists) in ecological time

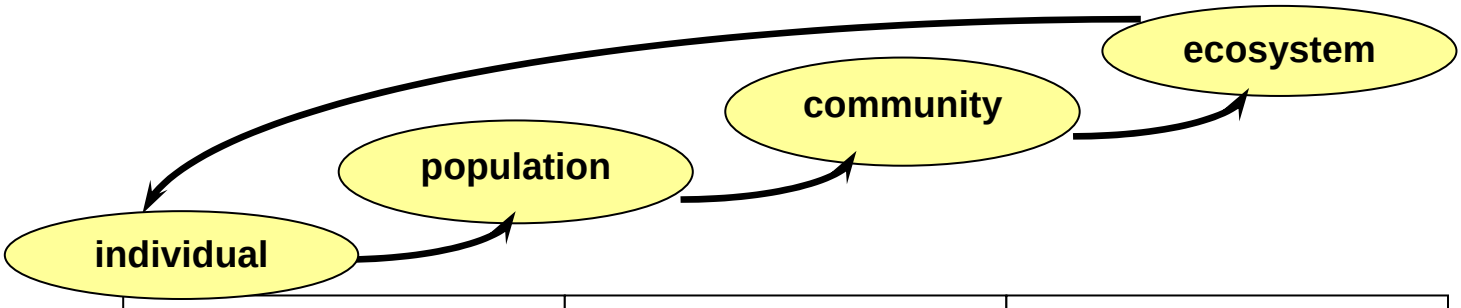
J To understand the dynamics of evolutionary change due to all processes that cause evolution

K You will improve your cognitive skills at critical thinking and reflective judgement

L To understand the evolution of the design of the organism (behavior, physiology, morphology) as “adapted” over evolutionary time to selection from its total environment

M To understand the vast interdependencies between our global society and the natural world

#6. This question will assess your understanding of the key "emergent properties" at the higher levels of ecological organization that cannot be predicted by knowledge of lower levels alone. In the three spaces below, list the key "emergent properties" for the Population, Community, and Ecosystem levels.

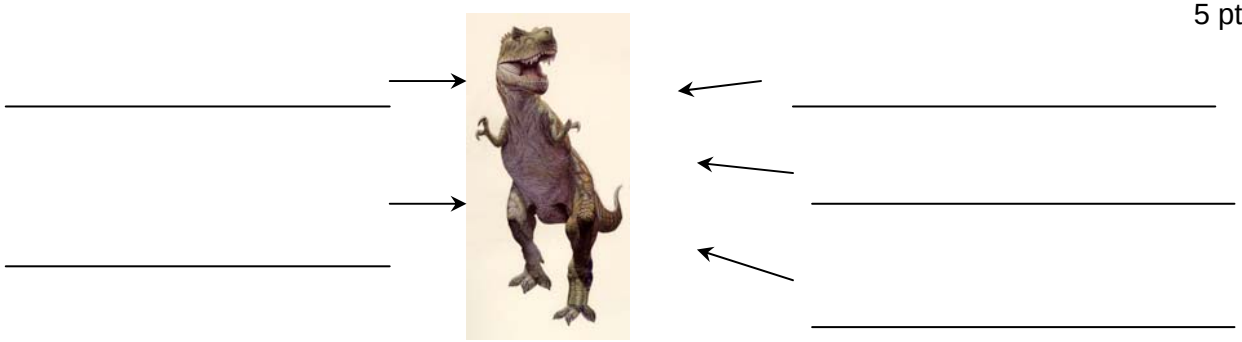


Emergent Properties at the **Population Level**:	Emergent Properties at the **Community Level**:	Emergent Properties at the **Ecosystem Level**:

3 pts

#7. Please write on the lines below what are the five environmental types that directly affect the day to day lives of individual organisms?

5 pts



#8. Please offer a brief but concise explanation of how Evolution can occur by natural selection (hint: there three specific conditions).

(6 pts)

#9. By the year 2006, it is predicted that Zebra mussels will have invaded every waterway in the lower 48 states of the USA. List five different life individual history characteristics of Zebra mussels that make them such good ecological invaders.

(2 pts)

#10. Please offer a brief definition of an "ecological energy budget".

(3 pts)

#11. This question will assess you understanding of the evidence provided by Konrad Lorentz on the evolution of behavior.

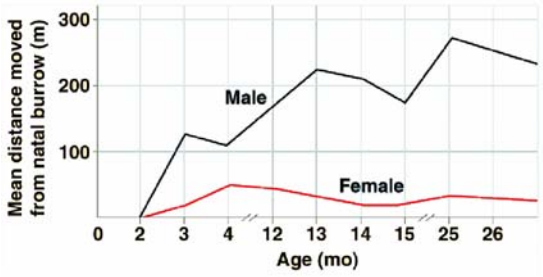
******** Please, fill in the blanks with the SINGLE BEST WORD or PHRASE*******

At left is a photo of Konrad Lorentz as he is followed by a row of young geese that were _____ on his boots because these were the first big things these geese saw at hatching. This result tells us about the nature versus _____ debate because the geese evidently were told by their _____ that the first big thing they saw in their _____ upon hatching would be their mother and thus should be followed. Thus both _____ and _____ are important in determining this behavior. (3 pts)

#12. Please offer a brief but concise definition of **altruism**.

(3 pts)

#13. At right is a figure showing the average distance traveled by male and female prairie dogs from their family colony. Based on these data, which sex would you expect to give "alarm calls" to warn the other prairie dogs nearby of an approaching predator (such as a hawk)?
Please explain your reasoning.



(3 pts)

#14. According to the CIA Word Fact Book (http://www.cia.gov), the global population birth rate is 20.4 births/1,000 people, and the death rate is 8.8 deaths/1,000 people (as of July 2003).

If the human population is about 6.3 billion now (2003), what will be the size of the population next year? Please set up the equation to calculate the human population for next year (2004). {Note: you do not need a calculator – I have provided a table of useful multiplication facts below. The rest is simple addition}

N (next time) = N (now) + births – deaths

SHOW ALL WORK

(5 pts)

#15. Consider the simple logistic model of single species population growth. Please briefly explain IN WORDS what do we mean by "density-dependent" population regulation - how does the equation above include "density-dependence"?

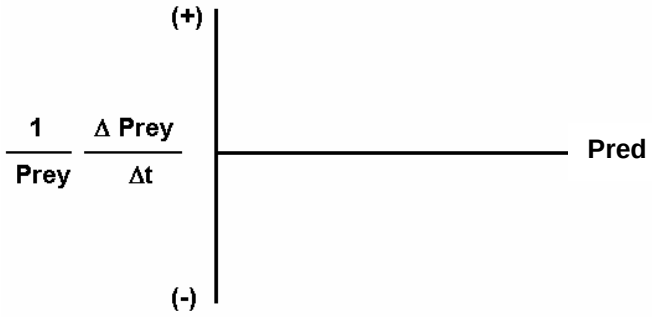
$$\frac{1}{N} * \frac{\Delta N}{\Delta t} = r * \left[1 - \frac{N}{K} \right]$$

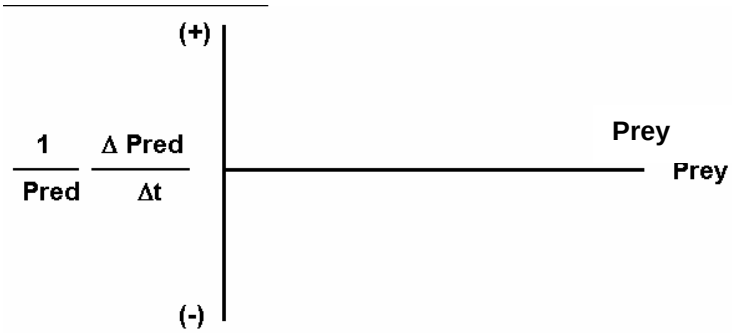
(3 pts)

#16. Consider the simple model of the predator-prey interaction:

$$\frac{1}{Prey}\frac{\Delta\ Prey}{\Delta t} = r_1 - alpha * Pred \qquad \frac{1}{Pred}\frac{\Delta\ Pred}{\Delta t} = -r_2 + beta * Prey$$

For each of these equations, sketch the corresponding relationships between growth and density on the axes below – please label ALL constants.





(4 pts)

#17. This question will assess your understanding of how to code the above model in EXCEL. In the box at right below, please enter the exact code that would successfully simulate the above model:

	A	B	C	D	E	F	G
1	time	prey	pred	r1	r2	alpha	beta
2	0	100	20	0.05	0.1	0.001	0.001
3	1						
4	2						
5	3						
6	4						
7	5						
8	6						
9	7						
10	8						
11	9						
12	10						
13	11						
14	12						
15	13						
16	14						
17	15						

C3 =

B3 =

(4 pts)

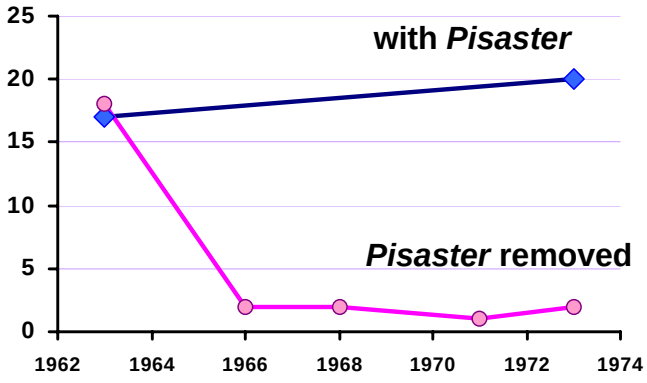
#18. Please offer a concise definition of coevolution. (3 pts)

#19. Please explain how the story of the tarantula and the tarantula hawk wasp might be an example of coevolution of predator and prey.

(3 pts)

#20. At right is a diagram of the research results by Robert Paine on causes of species diversity in the intertidal in the Pacific northwest.

***** Please, fill in the blanks with the SINGLE BEST WORD or PHRASE****



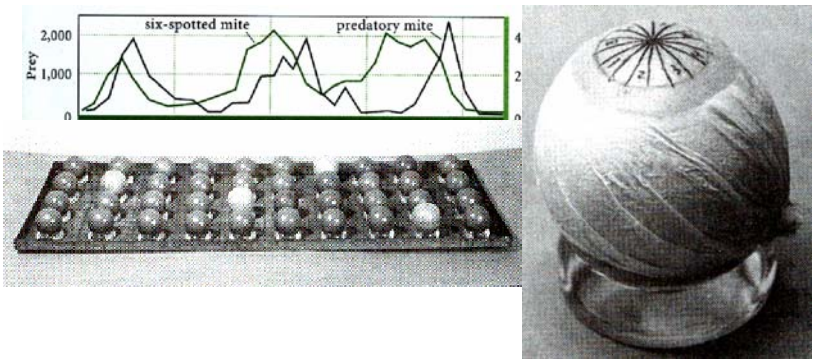
The figure at right shows that when the seastar *Pisaster* was removed, the diversity quickly _____. This occurred because *Pisaster* was a voracious predator on a single species of mussel that was relatively rare when _____. However, without Pisaster, these mussels proliferated, and as a result other species, such as limpets, other bivalves, marine plants, and barnacles were absent because

_____

_____.

(3 pts)

#21. One of the most important lab studies of predator prey dynamics was Huffaker's (1957) study of predator and prey mites living in trays of rotting oranges.



WHY exactly did the predators coexist with their prey (as opposed to hunting their prey to extinction), and what are the general conclusions we can draw from Huffaker's research?

(4 pts)

#22. Of what economic value is biodiversity to humans? Please list <u>and briefly explain</u> three totally different ways in which biodiversity is of economic value. {Hint: this question is NOT about aesthetics, it's about economics. }

3 pts)

Longer Answer Questions:

Question #1. Please use a diagram and briefly explain what is the greenhouse effect?

(6 pts)

What are three of the principal greenhouse gasses? (3 pts)

Current models predict that +2-5^{o}C warming is likely by 2100 if nothing is done and atmospheric CO_2 concentration is allowed to double. Please list at least three of the principal predictions for what is likely if global warming on this magnitude were to occur. (6 pts)

Question #2. According to archeologist Gary Rollefson, the dramatic abandonment of the Neolithic settlements such as the 'Ain Ghazal at 6000 b.c. was due to anthropogenic degradation of the fragile Jordan Valley ecosystem.

Imagine yourself as one of the members of this community at about 6100 b.c., just prior to its abandonment. What were the major environmental signposts that the 'Ain Ghazal culture and way of life were nearing a collapse?

(5 pts)

Please list 5 major global environmental signposts that <u>our</u> "modern" culture and way of life are not sustainable. (note: precision is not expected for any numbers you give)

(10 pts)

Question #3. This question will test your understanding of ecological economics. Below is a sketch of the relationships between "natural capital," "human capital," and "human-generated waste" that we used in class to describe the present unsustainable economic system (referred to as the "Neolithic" model).

(a). List and briefly explain the three basic assumptions under which this economic model operates:

(6 pts)

(b). List and briefly explain the three basic assumptions under which a "sustainable" economic system (or the "post-Neolithic" model) would operate:

(6 pts)

(c). Herman E. Daly, an internationally recognized economist, once wrote that "There is something fundamentally wrong in treating the earth as if it were a business in liquidation..." Please briefly explain what he meant by this comment. Exactly what is being liquidated?

(3 pts)

Tropical Rainforest Ecosystem

Urban Ecosystem

Question #4. For this question, choose one of the above two – either the tropical rainforest or the urban ecosystem and answer the question in the space provided.

Circle your choice ⟶ Tropical Rainforest Ecosystem or Urban Ecosystem

Why do we need to understand the structure and function of this ecosystem type? Of what value to humanity is an ecological understanding of this ecosystem type?

Explain and defend your answer using details discussed in class or from your readings. (Use the back of this page if necessary.)

(15 pts.)