Term 1 – Extra Credit - Free Response Questions

Complete the following on a separate piece of paper. For each reasonably correct answer (grade of 8,9,10) you will get ? points added to your last test grade. Answer the question like you would a normal free response question. Do as many questions as you want, or do none. Do them by yourself.

1) The following experiment was designed to test whether different concentration gradients affect the rate of diffusion. In this experiment, four solutions (0% NaCl, 1%, NaCl, 5% NaCl, and 10% NaCI) were tested under identical conditions. Fifteen milliliters (mL) of 0% NaCl were put into a bag formed of dialysis tubing that is permeable to Na+, Cl^-, and water. The same was done for each NaCI solution. Each bag was submerged in a separate beaker containing 300 mL of distilled water. The concentration of NaCl in mg/L in the water outside each bag was measured at 40-second intervals. The results from the 5% bag are shown in the table. below.

CONCENTRATION IN mg/L OF NaCl OUTSIDE THE 5% NaCl BAG

Time (seconds)	NaCI (mg/L)
40	130
80	220
120	320
160	400

(a) Using the proper axes provided, graph the data for the 5% NaCI solution.

(b) Using the same set of axes, draw and label three additional lines representing the results that you would predict for the 0% NaCl, 1% NaCl, and 10% NaCl solutions. Explain your predictions.

(c) Farmlands located near coastal regions are being threatened by encroaching seawater seeping into the soil. In terms of water movement into or out of plant cells, explain why seawater could decrease crop production. Include a discussion of water potential in your answer.

2) Describe the structure of the plasma membrane and the various ways in which the plasma membrane permits interactions with the outside environment.

3) Describe the process of cell division in plants and animals giving specific attention to the following.

a. The stages of mitosis, cytokinesis, and other phases of the cell cycle (do not include meiosis)

b. Factors that induce cells to divide

c. Factors that might contribute to abnormal cell divisions such as cancer A species is an interbreeding group of organisms that are reproductively isolated from other groups of that species.

4. In an experiment, a student worked with two species of flour beetles, *Tribolium confusum* and *Tribolium castaneum*. Four pairs of *T. confusum* were placed into a container of flour. Four pairs of *T. castaneum* were placed into a second container of flour. Four pairs of *T. confusum* and four pairs of *T. castaneum* were placed into a third container of flour. Each container held the same amount of flour and was kept under the same environmental conditions. The table below indicates the results of the experiment for a nine month period.

	Population of Organism Per Container			
Months	*T. confusum* Container #1	*T. castaneum* Container #2	*T. confusum* Container #3	*T. castaneum* Container #3
1	8	8	8	8
2	18	16	14	19
3	32	46	26	40
4	48	58	25	50
5	70	88	15	75
6	85	109	10	90
7	40	60	0	50
8	35	43		25
9	20	15		5
10				
11				

5) Reproductive isolation protects a coadapted gene pool that gives rise to a limited number of phenotypes.

a. Define and discuss briefly each of the mechanistic terms listed below.
   (i) allopatric speciation
   (ii) sympatric speciation
   (iii) parapatric speciation

b. Define the term prezygotic isolating mechanisms.

c. List and describe four main categories of prezygotic species-isolating mechanisms.

6) A scientist working with *Bursatella leachii,* a sea slug that lives in an intertidal habitat in the coastal waters of Puerto Rico, gathered the following information about the distribution of the sea slugs within a ten-meter square plot over a 10-day period.

DISTRIBUTION OF SLUGS WITHIN A ThN-METhR SQUARE PLOT

Time of Day	Average Distance Between Individuals (cm)
Midnight	8.0
4 A.M.	8.9
8 A.M.	44.8
Noon	174.0
4 P.M.	350.5
8 P.M.	60.5
Midnight	8.0

a. For the data above, provide information on each of the following.
   - Summarize the pattern.
   - Identify 3 physiological or environmental variables that could cause the slugs to vary their distance from each other.
   - Explain how each variable could bring about the observed pattern of distribution.

b. Choose ONE of the variables that you identified and design a controlled experiment to test your hypothetical explanation. Describe results that would support or refute your hypothesis.

4. Nutrients cycle through ecosystems.

   a. Describe the basic components of an ecosystem.

   b. Using the complete list below, construct a food web. Indicate the trophic level for each.

BRUSH VEGETATION	ROBIN
CARIBOU	SOIL BACTERIA AND FUNGUS
EAGLE	SPIDER
HERBIVOROUS INSECT	WOLF