請按順序作答

I. Multiple choice (Choose the best answer for each question, 3 points per question)

※ 本大題請於試卷內之「選擇題作答區」依序作答。

1. Which of the following statements does NOT apply to El Niño events?
   A. El Niño events occur when the Southern Oscillation index is high.
   B. El Niño events occur when barometric pressure is lower in the western Pacific than in the eastern Pacific.
   C. El Niño events include the appearance of warm currents on the Pacific coast of South America.
   D. El Niño events are always accompanied by La Niña events at the same time.
   E. El Niño events are accompanied by westward movement of the location of storm generation in the Pacific.

2. Which of the following statements does NOT apply to forest edges?
   A. Trees grow more rapidly and survive better in edge habitat than in the forest nterior.
   B. Edge habitat is drier than the forest interior.
   C. Edge habitat has higher solar radiation than the forest interior.
   D. Edge habitat is hotter than the forest interior.
   E. Forest fragmentation increases the ratio of edge habitat to forest interior.

3. Remote sensing of chlorophyll *a* concentrations in the Earth's oceans has revealed that marine plankton biomass is
   A. nearly homogenous over huge expanses of ocean.
   B. highest in the open ocean.
   C. highest in the warmest waters.
   D. highest in the deepest waters.
   E. highest in cooler, upwelling areas near shore.

4. Which of the following is NOT a hypothesis proposed by ecologists to explain increased species diversity in the tropics?
   A. increased time since perturbation in the tropics over temperate regions
   B. increased productivity in the tropics over temperate regions
   C. increased environmental homogeneity in the tropics over temperate regions
   D. increased favorable environments in the tropics over temperate regions
   E. increased speciation rates and decreased extinction rates in the tropics over temperate regions.

5. According to the "inhibition" hypothesis, pioneer species modify the environment in ways that
   A. make it less suitable for other species.
   B. make it less suitable for their own survival, but more suitable for survival of other pioneer species.
   C. make it less suitable for their own survival, but more suitable for survival of late-successional species.
   D. make it more suitable for survival of all species.
   E. in this model, pioneer species do not modify the environment.

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6. The "trophic cascade hypothesis" emphasizes the role of
   A. nutrients in controlling primary productivity.
   B. nutrients in controlling primary consumption.
   C. consumers in controlling primary productivity.
   D. grazing by herbivores in controlling ecosystem nutrient levels.
   E. primary productivity in controlling primary and secondary consumption.

7. Nutrient poor soils should favor mycorrhizal fungi that are
   A. less aggressive at obtaining sugars from their plant host.
   B. more aggressive at obtaining sugars from their plant host.
   C. more efficient at extracting inorganic nutrients from soil.
   D. more efficient at extracting sugars from soil.
   E. more efficient at extracting inorganic nutrients from plant root exudates.

8. Which statement about snowshoe hare and lynx populations in boreal Canada is false?
   A. Lynx are not the only important predator of snowshoe hares.
   B. Lynx and hare populations both oscillate repeatedly, with a similar period.
   C. Snowshoe hares rarely deplete their food supply enough to affect their population biology.
   D. Trapping records kept by non-scientists can provide useful records of hare population sizes.
   E. Field experiments imply that hare cycles depend both on the hares' food and their predators.

9. Based on the Lotka-Volterra competition model, two competitors can coexist only when
   A. interspecific competition is stronger than intraspecific competition.
   B. intraspecific competition is stronger than interspecific competition.
   C. intraspecific and interspecific competition are equally strong.
   D. predation or parasitism is stronger than interspecific competition.
   E. Actually, the model implies that two competitors can never coexist.

10. Field experiments differ from laboratory experiments in that
    A. laboratory experiments include controls, but field experiments need not.
    B. field experiments can be more easily replicated than laboratory experiments.
    C. laboratory experiments allow variables not of direct interest to be controlled, while in field experiments these typically vary.
    D. field experiments can teach us about ecological systems, but laboratory experiments cannot.
    E. field experiments are often used by ecologists, but laboratory experiments never are.

II. Explain the following terms (30 points, 3 points for each) ※本大題請於試卷內之「非選擇題作答區」標明題號依序作答。
   1. buttom-up control of primary production
   2. biogeochemical cycle
   3. character displacement
   4. competitive exclusion principle
   5. Hardy-Weinber principle
   6. keystone species

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7. mineralization
8. phenotypic plasticity
9. realized niche
10. succession

III. Short answer questions ※ 本大題請於試卷內之「非選擇題作答區」標明題號依序作答。

1. Calculate the generation time given the following population data: (5 points)
   $R_0 = 0.601$, $r = -0.05$, $\sum x l_x m_x = 6.4$, $m_x = 0.96$

2. What are the three factors *Rabinowitz* used to devise commonness (or rarity) classification of a species? (5 points)

3. Define and compare numerical response and functional response of predators. (5 points)

4. Draw a graph to explain the equilibrium theory of island biogeography. (5 points)

5. (1) Describe the geometric or exponential population growth. When it happens?
   (2) What is meant by the carrying capacity of a population? Describe when it happens and why in S-shape population growth curve. (10 points)

6. Draw a diagram of the global carbon cycle, label major reservoirs and flows. Explain why human caused changes to the global carbon cycle are affecting earth's climate. (10 points)

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