

I. True/False Questions (10%) ※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

1. (T/F) Soil is an abiotic environment.
2. (T/F) The net reproductive rate (R_0) refers to the average number of females that will be produced during a lifetime by a newborn female.
3. (T/F) No population continues to grow in size indefinitely.
4. (T/F) Studying competition in the laboratory is more complex than studying competition in the field.
5. (T/F) Large habitat patches typically contain more individuals and species than smaller habitat patches.

II. Fill-in the blank (20%) ※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

1. A(n) _____ is an abstract, simplified representation of a real system, allowing us to predict some behavior or response using a set of explicit assumptions.
2. There is a strong positive correlation between rising atmospheric CO_2 concentrations and _____.
3. A(n) _____ is any heritable behavioral, morphological, or physiological trait of an organism that has evolved over a period of time by the process of natural selection.
4. The type of natural selection in which the mean value of a trait is shifted toward one extreme is called _____ selection.
5. _____ mating occurs when individuals choose mates nonrandomly with respect to some phenotypic trait.
6. In some shade plants, the negative effect of high light levels on the rate of photosynthesis is referred to as _____.
7. Many insects undergo _____, a stage of arrested development in their life cycle from which they emerge when conditions improve.
8. _____ occurs when two species undergo reciprocal evolutionary change through natural selection.
9. Variation in environmental conditions within a community is referred to as environmental _____.
10. Succession that occurs on a site that was previously unoccupied by another community is called _____ succession.

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III. Multiple-Choice Questions (30%) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. A waxy layer coating the aerial parts of most plants, such as stems and leaves, which reduces water loss is referred to as the
 - A. meristem.
 - B. vascular cambium.
 - C. cuticle.
 - D. xylem.

2. In comparison with a blue whale, a shrew has
 - A. a larger surface area relative to volume.
 - B. the same surface area relative to volume.
 - C. a slightly smaller surface area relative to volume.
 - D. a much smaller surface area relative to volume.

3. An ecologist spent a year studying the population dynamics of a species of duck on a lake. At the beginning of the year, there were 86 adults. Of these, 16 adults left the lake, 12 adults arrived on the lake from elsewhere, 76 chicks hatched from eggs, 24 chicks survived to become adults, and 8 adults died. How many individuals emigrated?
 - A. 8
 - B. 12
 - C. 16
 - D. 24

4. Reproductive success of an organism is best measured by its
 - A. fitness.
 - B. ability to attract a mate.
 - C. number of offspring that survive to reproduce.
 - D. life span.

5. The carrying capacity is the population size at which dN/dt
 - A. is positive.
 - B. is negative.
 - C. is equal to 0.
 - D. is equal to N .

6. Which statement best describes a keystone species?
 - A. a rare or uncommon species that has a strong effect on its community
 - B. an abundant species that may or may not affect other species
 - C. a species that takes up a great deal of space in a community
 - D. a common species that has a strong effect on its community

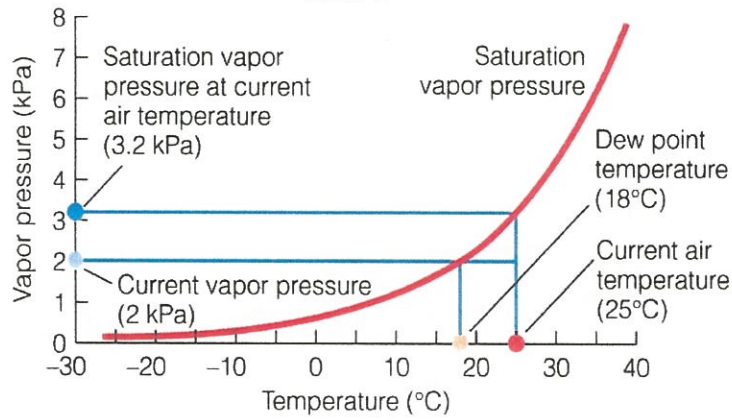
7. Which of the following patterns occurs with respect to geographic distribution of species diversity?
 - A. Diversity increases with increasing latitudes.
 - B. Diversity increases with increasing longitudes.
 - C. Diversity increases with decreasing latitudes.
 - D. Diversity increases with decreasing longitudes.

8. Based on the figure below, what would be the approximate dew point when the vapor pressure is 1 kPa?

- A. 25°C
- B. 10°C
- C. 18°C
- D. 1°C

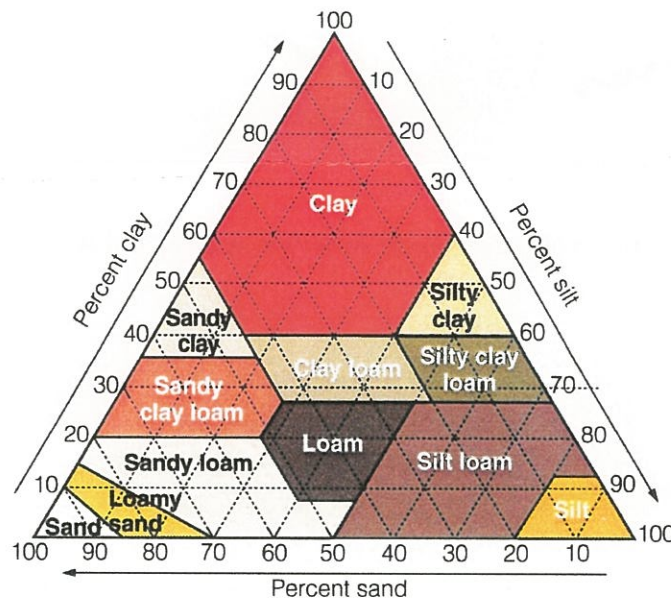
$$\text{Relative humidity} = \frac{\text{Current vapor pressure}}{\text{Saturation vapor pressure}} \times 100$$

$$\text{Relative humidity} = \frac{2 \text{ kPa}}{3.2 \text{ kPa}} \times 100 = 62.5\%$$



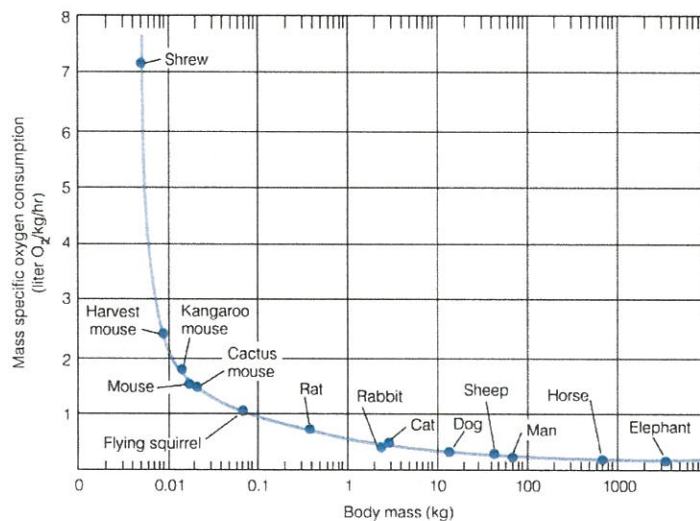
9. Based on the figure below, a soil that is 10% silt, 80% sand, and 10% clay would be considered

- A. clay loam.
- B. sandy clay.
- C. slit loam.
- D. loamy sand.



10. Based on the figure below, which of the following animals has the highest mass specific oxygen consumption?

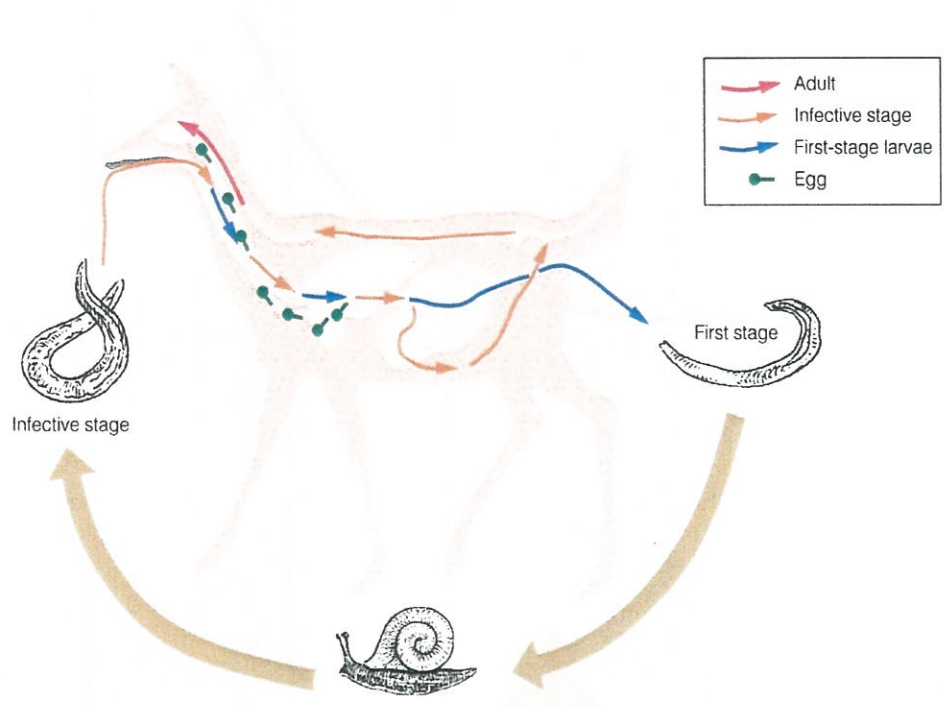
- A. elephant
- B. sheep
- C. mouse
- D. man



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11. Based on the figure below, which of the following is the definitive host?

- A. deer
- B. soil
- C. snail
- D. free living stage



12. After the breakup of Gondwana, new species evolved in South America, Africa, and Australia. Which speciation model best fits this vicariance event?

- A. Allopatric speciation
- B. Sympatric speciation
- C. Parapatric speciation
- D. Peripatric speciation

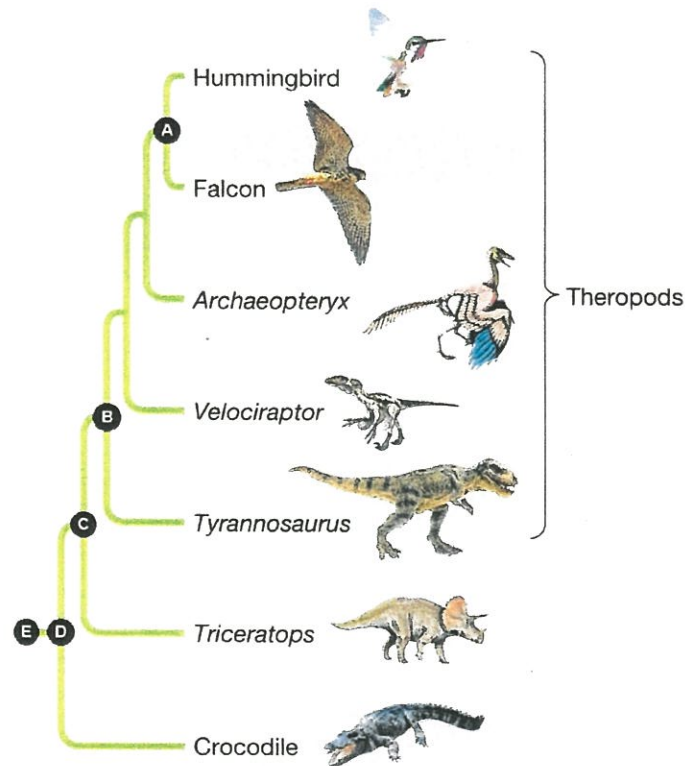
13. A population of finches on an oceanic island varies at a particular gene locus. The current allele frequency is $A_1 = 40\%$, $A_2 = 60\%$, and there are 12,000 birds on the island. On the nearest continental mainland, the same species is monomorphic for allele A_1 . If 3,000 birds migrate from the mainland to the island, by how much will the frequency of allele A_1 change on the island?

- A. 0.08
- B. 0.12
- C. 0.15
- D. 0.45

14. A major event in the history of life was the evolution of multicellularity, which is a prerequisite for

- A. endosymbiotic bacteria.
- B. an increase in the availability of nitrogen.
- C. large body size and the development of organs.
- D. protein synthesis.

15. Refer to the figure. The organisms shown here are all “archosaurs.” The first six are “dinosaurs,” but Crocodiles are not.



The node that represents the most recent common ancestor of all archosaurs is _____, and the node that represents the most recent common ancestor of all dinosaurs is _____.

- A. E; A
- B. E; B
- C. C; B
- D. D; C

IV. Essay Questions (40%) ※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號。

1. Describe several adaptations that have evolved in organisms in response to the minimal light environments in deep water. (5%)
2. Explain how the effects of mutation, genetic drift, and gene flow influence the genetic variation of a population. (5%)
3. Discuss the differences between the C4 and CAM pathways of photosynthesis. Under what environmental conditions is the CAM pathway advantageous and why? (5%)
4. Discuss five factors known to cause extinction. Which factor is considered the leading cause of current extinctions and why? (5%)
5. Define five types of species interactions based on their reciprocal effects. (5%)
6. Compare and contrast two types of mimicry, and give an example of each. (5%)
7. Kin selection explains why organisms provide benefits to relatives. Is there a conflict between the principle of kin selection and the evolution of siblicide? (5%)

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題號： 444

國立臺灣大學 109 學年度碩士班招生考試試題

科目： 生態與演化生物學

題號： 444

節次： 7

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8. The ratio of nonsynonymous differences per nonsynonymous site, dN , to synonymous differences per synonymous site, dS , can be used to test for positive selection. Imagine that in a duplicate pair of loci, one paralog is evolving neutrally while the other is evolving under strong positive selection. What specific data are needed to detect that situation using the dN/dS ratio, and what pattern do you expect to see? (5%)

試題隨卷繳回