

※ 注意：請於試卷上「非選擇題作答區」內依序作答，並應註明作答之部份及其題號。

Multiple-choice questions (4 points each, 20 points in total)

單選題；每題4分，共20分

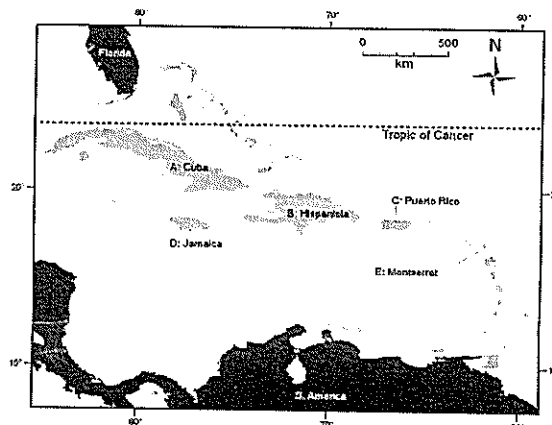
1. Woodland populations of the snail have shells that are predominantly brown or pink, whereas meadow populations usually have yellow shells. The most-common shell color is the one that most closely matches the background environment where the snail resides, and therefore offers camouflage protection from predators. However, snails with shell colors that do not match their background can also persist in these populations because predators tend to focus their search on the most-common shell color. This type of selection favoring rarity is called _____. Source: Reznick & Travis (2017) Nature 546:218-219

- A. Frequency-dependent selection
- B. Kin selection
- C. Runaway selection
- D. Sexual selection
- E. Stabilizing selection

2. For a coding gene, the K_a/K_s ratio is calculated as the ratio of the rate of nonsynonymous substitutions per non-synonymous site (K_a) to the rate of synonymous substitutions per synonymous site (K_s). If a gene is experiencing purifying selection, the calculated K_a/K_s is expected to be _____.

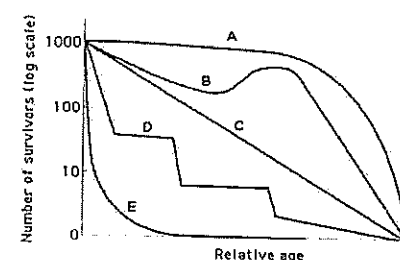
- A. > 2
- B. = 2
- C. > 1
- D. = 1
- E. < 1

3. Refer to the map on the right. Based on MacArthur and Wilson's theory of island biogeography, which of the following Caribbean islands is predicted to harbor the smallest number of species among the five listed here? The continental land mass is labeled in black and islands are in grey. Source: Wilson (1989) Sci Am 261(3):108-116



- A. Cuba
- B. Hispaniola
- C. Puerto Rico
- D. Jamaica
- E. Montserrat

4. Refer to the graph on the right. Which statement best explains survivorship curve B?



- A. It is likely a species where no individuals in the cohort die when they are at 60-70% relative age.
- B. This curve is likely of a species that produces lots of offspring, only a few of which are expected to survive.
- C. This curve could not happen in nature.
- D. It is likely a species that provides little postnatal care, but lots of care for offspring during midlife as indicated by increased survivorship.
- E. There was a mass emigration of young to middle-aged individuals in this cohort.

5. A hypothetical population of 200 cats has two alleles, T_L and T_S , for a locus that controls tail length. The table below describes the phenotypes of cats with each possible genotype, as well as the number of individuals in the population with each genotype. If this population fits the Hardy-Weinberg principle, which of the following statements about the population is true?

Genotype	Tail length	Number of individuals
$T_L T_L$	long	72
$T_L T_S$	medium	X
$T_S T_S$	short	Y

- A. $X = Y$
- B. $X = 2Y$
- C. $X = 3Y$
- D. $2X = 72$
- E. $X < Y$

見背面

Define or explain the following terms in either Chinese or English (4 points each, 48 points in total)

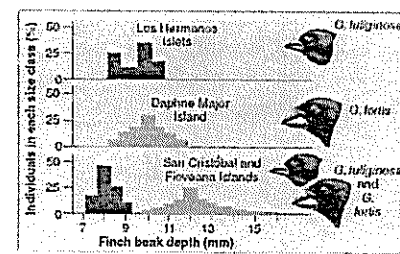
名詞解釋，以中文或英文作答，只翻譯名詞不給分；每題4分，共48分

- | | | | |
|-------------------------|------------------------|-------------------------|---|
| 6. Keystone species | 7. Hybrid zone | 8. Realized niche | 9. Metapopulation |
| 10. Batesian mimicry | 11. Hamilton's rule | 12. Genetic hitchhiking | 13. Intermediate disturbance hypothesis |
| 14. Horizontal transfer | 15. Paraphyletic group | 16. C-value paradox | 17. Refugia |

Answer the following questions in either Chinese or English – make your answer as concise as possible (32 points in total)

簡答題，以中文或英文作答；共32分

18. The *Geospiza* finches on the Galápagos are a classical example of an adaptive radiation. Their common ancestor arrived on the Galápagos about two million years ago. During the time that has passed these finches have evolved into 18 recognized species differing in body size, beak shape, song and feeding behavior. Changes in the size and form of the beak have enabled different species to utilize different food resources such as insects, seeds, nectar from cactus flowers as well as blood from seabirds, all driven by Darwinian selection. As shown in the graph displayed on the right, coexistence of two species on an island leads to the divergence of beak size between species. Source: Grant & Grant (2006) *Science* 313:224-226



What is the technical term for describing this phenomenon? (2 points)

Please provide a hypothesis to explain the mechanism for the evolutionary divergence in beak size. (4 points)

Please design an executable experiment to test your hypothesis. (4 points)

19. Considering interspecific brood parasitism observed among bird species, about 15-20 percent of all nestling cuckoo parasites are abandoned and left to die by their reed warbler hosts after two weeks of foster parent care. A scientist suspected that reed warblers had evolved a means to avoid helping parasites, namely a time limit on parental care for a brood. To test this hypothesis, the scientist manipulated broods of reed warbler chicks so as to extend the period of parental care needed for the young to fledge. In these experiments, younger and older chicks were transferred between nests. Source: Grim (2007) *Proc R Soc B* 274:373-381

Scientific hypotheses are derived from observations. One essential observation that allows the scientist to come up with the “time limit hypothesis” is missing from the above statement. What is it? (4 points)

If the time limit hypothesis is to be supported, how do you expect the parent reed warblers to respond to the chick transfer experiments? (4 points)

What is the evolutionary advantage of providing time-limited parental care over removing parasites in the brood actively? (4 points)

20. Please define ‘global warming.’ (2 points)

How global warming may impact a place like Taiwan? (4 points)

Why is global warming such an urgent issue requiring immediate human action? (4 points)

試題隨卷繳回