

題號： 406

國立臺灣大學 111 學年度碩士班招生考試試題

科目： 生態學(A)

題號： 406

節次： 3

共 6 頁之第 1 頁

請依題號順序作答

一、單選題 (每題 2 分, 共 78 分)

1. Lichens (地衣) represent a mutualistic relationship between

- (A) algae and invertebrate;
- (B) algae and vertebrate;
- (C) algae and fungi;
- (D) algae and mycorrhiza.

2. In the mutualistic relationship between plant and mycorrhizal fungi,

- (A) plants provide fungi with proteins, while fungi provide the plant with extra water;
- (B) plants provide fungi with soluble carbohydrates, while fungi provide the plant with inorganic compounds and better access to water;
- (C) plants provide fungi with inorganic compounds, and fungi provide the plant with extra glucose and better access to water;
- (D) plants provide fungi with housing, and fungi provide the plant with access to organic compounds.

3. Where would you search for an "intertidal ecosystem"? In the

- (A) river;
- (B) lake;
- (C) sea;
- (D) mountains.

4. Biotic interaction, where two species indirectly and negatively affect each other, is called

- (A) mutualism;
- (B) commensalism;
- (C) apparent competition;
- (D) indirect parasitism.

5. Diversity of species community includes these two components:

- (A) species composition and species richness;
- (B) species composition and species evenness;
- (C) species evenness and species richness;
- (D) species richness and species frequency.

6. Ecologists compared the diversity of plant species in two localities. In the first one, they found that the soil contains a higher amount of nutrients, and the community contains a lower number of species. In the second, the soil has a relatively low nutrient content, and the community has a higher number of species. This study is an example of

- (A) manipulative experiment;
- (B) repeated observation;
- (C) empirical observation;
- (D) literature review.

7. You hypothesize that higher nutrient content in the soil causes an increase in plant diversity. To test this hypothesis, you need to:

- (A) do empirical observation in nature;
- (B) do a manipulative experiment (e.g. in the greenhouse or common garden);
- (C) conduct meta-analysis of published studies;
- (D) test artificially simulated dataset.

8. You visited two forests. The first one had 10 species of trees, and all of them were relatively common. The second forest had 15 species of trees, but only two of them were dominant, three were common, and the rest was relatively rare. Which of the two forests has greater evenness?

- (A) The first forest.
- (B) The second forest.
- (C) Both have the same evenness.
- (D) From the information provided, you cannot say.

見背面

題號： 406
科目： 生態學(A)
節次： 3

國立臺灣大學 111 學年度碩士班招生考試試題

題號： 406
共 6 頁之第 2 頁

9. One of the commonly used diversity indices is called:
(A) Compositional index;
(B) Sørensen index;
(C) Shannon-Wiener index;
(D) Jaccard index.
10. Ecologists observed that when the community is under disturbance pressure, the highest diversity occurs when the disturbance is neither too high nor too low. This is called
(A) positive diversity-disturbance relationship;
(B) humpshape evenness-disturbance relationship;
(C) intermediate disturbance hypothesis;
(D) mid-domain effect.
11. Sea star (genus *Pisaster*) occurring in the intertidal zone is important because its presence regulates the dominance of other species (mainly barnacles) and increases their diversity. We call such important species
(A) top herbivores;
(B) dominant species;
(C) endemic species;
(D) keystone species.
12. A summary of feeding interactions between species within a community is an important description of community structure, and is called
(A) trophic levels;
(B) feeding network;
(C) food cycle;
(D) food web.
13. There are two types of primary production, gross and net. While gross production is the total primary production by all primary producers, net production is
(A) gross production minus the respiration by primary producers;
(B) gross production plus body remnants of all consumers;
(C) production by only vascular plant producers (but not by algae and other organisms);
(D) gross production recalculated per unit area.
14. While terrestrial primary production is generally limited by nutrients, temperature, and moisture, primary production in aquatic ecosystems is mainly limited by
(A) water pH;
(B) water temperature;
(C) nutrient availability;
(D) water transparency.
15. To estimate the primary production of herbs in the temperate grassland community, scientists usually
(A) measure nutrients in the soil;
(B) harvest the aboveground biomass during the winter, when most of it is dead and easy to collect;
(C) harvest the aboveground biomass during the peak summer season;
(D) estimate the cover of all plants in the grassland.
16. To estimate the primary production of woody species in the forest community, scientists usually
(A) cut all trees and weigh their overall biomass;
(B) measure the increase in diameter of trees each year and recalculate it to the increase of wood biomass;
(C) estimate the leaf canopy of the forest;
(D) measure the height of all trees and calculate their average.
17. In the phosphorus cycle, the main source of P is
(A) decomposition of organic material;
(B) marine sediments and mineral deposits, from which it releases by weathering;
(C) fixation by P-fixing bacteria;
(D) phosphates dissolved in oceans.

接次頁

題號： 406

國立臺灣大學 111 學年度碩士班招生考試試題

科目： 生態學(A)

題號： 406

節次： 3

共 6 頁之第 3 頁

18. After a landslide (在山坡坍方之後) happens and the part of the mountain slope and organic material slides down into the valley, vegetation slowly recovers by primary succession. At the initial stage of the succession, plants growing on the landslide are limited by

- (A) nitrogen;
- (B) phosphorus;
- (C) too intensive light,
- (D) animal browsing.

19. Litter decomposition is an important ecological process because it

- (A) reduces the competition from the dead biomass in the community;
- (B) releases water stored in the dead biomass for use by other organisms;
- (C) reduces the risk of fire due to biomass accumulation in the stand;
- (D) releases the nutrients fixed in the dead organic litter for use by other organisms.

20. In the experiment conducted to prove that Island Biogeography Theory works, scientists used patches of mangrove islands in the coastal region of Florida. They separated the islands into control and treatment ones, and then

- (A) killed all insect in the treatment islands and then tracked for one year how fast the islands near and far from the mainland will be recolonized;
- (B) cut mangroves in the treatment islands and then tracked for one year how fast they will grow back;
- (C) introduced invasive insect species to all islands and tracked for one year how quickly they will be outcompeted by native species;
- (D) killed all insect in the control islands and then tracked for one year how fast they will be recolonized by the insect from the surrounding treatment islands.

21. Anthropogenic climate change

- (A) decreases the global temperature and influences mostly the tropical and subtropical forests, which more often suffer from frost events (remember the snow falling in Taiwan last year?);
- (B) warms the ocean water and causes the change in the directions of the ocean currents; as a result, there is more rain in dry areas, leading to such anomalies as flowering deserts;
- (C) is a directional change in global climate, which lasts for several decades, and is most probably caused by human activities (burning fossil fuels and deforestation);
- (D) does not exist because scientists never found any evidence of it.

22. The ozone layer in the stratosphere has a critical function to protect the earth's surface from destructive UV-B radiation. Ozone hole (reduced concentration of the ozone) is caused by

- (A) deforestation, mainly of the Amazonian rainforest;
- (B) burning fossil fuels;
- (C) releasing chlorofluorocarbons (CFC) to the atmosphere, used primarily as filling in refrigerators;
- (D) methane released by agricultural production.

23. During the secondary succession in the forest, with time, the number of woody species

- (A) decreases, being highest at the initial stages of the succession;
- (B) increases and then levels off, being highest in the climax vegetation;
- (C) does not change – pioneer species at the early stage of the succession are slowly replaced by the same number of climax species in the late stage.
- (D) is unpredictable and depends on the forest system under study.

24. The Theory of Island Biogeography predicts that:

- (A) larger islands will have fewer species than smaller islands;
- (B) more isolated islands will have more species than less isolated islands;
- (C) larger and less isolated islands will have more species than smaller and more isolated islands;
- (D) smaller islands are always more isolated.

25. Annual actual evapotranspiration (AET), which represents the total amount of water that evaporates and transpires off a landscape during one year, and is measured in mm of water per year, is influenced by

- (A) temperature and air humidity;
- (B) precipitation and air humidity;
- (C) precipitation and temperature;
- (D) precipitation and wind speed;

見背面

題號： 406
科目： 生態學(A)
節次： 3

國立臺灣大學 111 學年度碩士班招生考試試題

題號： 406
共 6 頁之第 4 頁

26. A researcher was culturing *Escherichia coli* in a regular petri dish. Which type of population growth best describes what happened in the petri dish during the first five hours in his *E. coli* culture?

- (A) Logistic growth
- (B) Exponential growth
- (C) Geometric growth
- (D) Linear growth
- (E) Logarithmic growth

27. Where does the majority of the net primary production go?

- (A) Being processed in by decomposers and detritivores
- (B) Being grazed by herbivores
- (C) Being stored in the soil
- (D) Being stored in plants after being photosynthesized

28. Tundra is one of the terrestrial biomes that has been affect by the increasing atmosphere temperature the most, because

- (A) melting of ice in the soil leads to the release of a lot of N₂O into the atmosphere
- (B) melting of ice in the soil leads to the release of a lot of CH₄ into the atmosphere
- (C) tundra is rapidly replaced by boreal forest due to increasing temperature
- (D) tundra is rapid replaced by temperate forest due to increasing temperature

29. In the logistic growth model of population growth, at what population size - in terms of the carrying capacity (K) - is the population increasing most rapidly?

- (A) K
- (B) K/2
- (C) K/3
- (D) K/4

30. What is the main reason leading to a uniform dispersion pattern among individuals of organisms?

- (A) Resource availability
- (B) Environmental factors
- (C) Mutualism
- (D) Competition

31. Regarding the global carbon cycle, which is the largest active terrestrial carbon pool?

- (A) Animal
- (B) Plant
- (C) Soil
- (D) Forest
- (E) Tundra

32. 某日一位國立台灣大學的生態學教授在台東的低海拔山區採樣，這天教授在樣區裡看到了一隻山羌、一群野狗、一隻野貓、一隻大冠鷲、很多福壽螺、二棵銀合歡、一池布袋蓮、以及漫山遍野的小花蔓澤蘭。依據外來入侵種的概念，上述的物種有幾種是外來入侵種？

- (A) 3
- (B) 4
- (C) 5
- (D) 6
- (E) 7

33. Which of the following about osmoregulation in fish is INCORRECT?

- (A) Most marine fish do not drink water as the sea water is too salty.
- (B) Fresh water fish acquires salt from food.
- (C) Marine fish gets rid of salt through their gill
- (D) Fresh water fish produces urine that contains a lot of water.

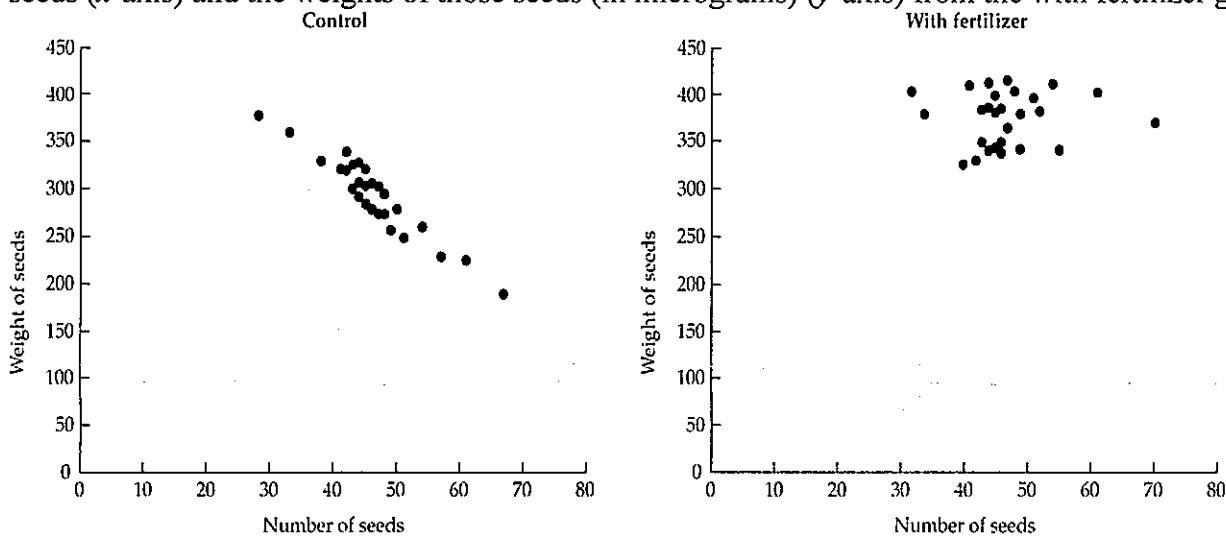
接次頁

34. Given the major population growth models described in a college ecology textbook, which of the following populations would be expected to remain stable in size?

- I. A population with an r of 1
- II. A population with a λ of 1
- III. A population with an r of 0
- IV. A population with a λ of 0

- (A) I
- (B) II
- (C) Both I and II
- (D) Both II and III
- (E) Both I and IV

35–36. Refer to the following two graphs. Seedlings of an annual plant were split into two equal treatment groups; in one group, extra fertilizer was provided, and in the other, no additional fertilizer was added. These graphs are referred to as the “With fertilizer” and “Control” groups respectively. The numbers of seeds and the average weight of the seeds from each individual plant were monitored, and these data were plotted (each point represents an individual plant). The first graph represents the number of seeds (x -axis) and the weights of those seeds (in micrograms) (y -axis) from the Control group. The second graph represents the number of seeds (x -axis) and the weights of those seeds (in micrograms) (y -axis) from the with fertilizer group.



35. Fertilizer treatment _____ seed size and _____ seed number.

- (A) increased; had no effect on
- (B) increased; increased
- (C) had no effect on; decreased
- (D) had no effect on; increased
- (E) decreased; increased

36. Which of the following statements best describes the results of this study?

- (A) Trade-offs between seed size and seed number exist in both the Control and the Fertilizer groups, and these trade-offs are of roughly equal magnitudes.
- (B) Trade-offs between seed size and seed number exist in both the Control and the Fertilizer groups, but these trade-offs are much larger in the Fertilizer group.
- (C) A trade-off between seed size and seed number exists in the Control group, but does not exist in the Fertilizer group.
- (D) A trade-off between seed size and seed number exists in the Fertilizer group, but does not exist in the Control group.
- (E) Neither the Fertilizer nor the Control group showed a trade-off between seed size and seed number.

37. Which phenomenon below is, by itself, sufficient to document ongoing competition?

- I. Resource use difference
- II. Character displacement
- III. Niche partitioning

- (A) I only
- (B) II only
- (C) III only
- (D) II and III
- (E) I, II and III

題號： 406
科目： 生態學(A)
節次： 3

國立臺灣大學 111 學年度碩士班招生考試試題

題號： 406

共 6 頁之第 6 頁

38. Which of the following is a resource?
I. Oxygen being depleted by zooplankton in the ocean
II. Oxygen breathed by tigers in the jungle
III. Water in which dolphins are swimming
(A) I
(B) II
(C) III
(D) Both I and II
(E) None of these

39. Herbivores that eat _____ can be considered predators.
(A) stems
(B) leaves
(C) seeds
(D) roots

二、簡答題 (共 2 分)

40. A sentence appeared in a news article: "In the study, the researchers investigated the population of butterflies in the main campus of National Taiwan University." From an ecologist's perspective, what is wrong with this sentence? Answer this question with no more than 20 words. (2 points)

三、申論題 (共 20 分)

41. Pick **a species or a group of terrestrial animals or plants that is native to Taiwan**. Assuming that you have finished writing a research proposal to request for funding (400,000 NTD) from the university. The proposal is focused on one or several ecological aspects of the group or the species that you are interested in. Now you need to write the Project Summary so that you can finalize the proposal and submit it. The Project Summary needs to be divided into two parts: (1) Overview; (2) Intellectual Merit.

(a) Write the **Overview** section. In this section, you need to give a short introduction on the background of the research, followed by stating your research objective(s) and your specific aims. You could also specify your hypotheses if you have them. Following your specific aims or hypotheses, you need to state, very briefly, your research approach to tell the reviewers how you want to address your aims or test your hypotheses. Make sure that these approaches are reasonable and doable for you, a graduate student in the MS program in IEEB, to execute and finish within two years. (12 points)

(b) Write the **Intellectual Merit** section. In this section, you need to explain why the research you proposed is important from the perspectives of general ecology and specific research field in ecology (e.g. conservation biology). (8 points)

Reminder: the two sections are both part of the Project Summary. The two together need to provide a **coherent, complete, clear, and concise** summary of the proposed project.

試題隨卷繳回