請將正確答案填寫在答案卷第一頁上，切勿在此作答

Questions (2% each, **one answer for each question**)

1. _____ are transitions from one type of ecosystem to another, for instance, the transition from a woodland to a grassland. (A) zonations (B) ecotones (C) interaction (D) phase shift (E) biomes.

2. Which one is a desert organism? (A) cactus (B) cork oak (C) palm (D) maple (E) sugarcan.

3. _____ is a layer of water through which temperature changes rapidly with depth. (A) halocline (B) hadalcline (C) mesocline (D) thermocline (E) bathycline.

4. Which one is incorrect? A eutrophic lake with (A) low oxygen (B) high phosphorus (C) low nitrogen (D) high density of phytoplankton (E) favor tolerant organisms.

5. Heat exchange between organisms and the environment can be achieved by (A) metabolism (B) radiation (C) convection (D) conduction (E) all of the above.

6. Harmless species mimic noxious ones is called (A) aposematic mimicry (B) Mullerian mimicry (C) Batesian mimicry (D) Richard mimicry (E) Spitting mimicry.

7. Phenotypic variation among individuals in a population results from the effect of (A) genes (B) environment (C) adaptation (D) genes and environment (E) genes and adaptation.

8. The largest rain forest area on the planet is (A) Indonesia (B) Brazil (C) Argentina (D) Mexico (E) Peru.

9. Characteristics are favored by r-selected species. (A) slow development (B) iteroparity (C) late reproudction (D) large body size (E) none of the above.

10. The self-thinning rule predicts the relationship between population density and total biomass is (A) + + (B) + − (C) − + (D)

-- (E) none of the above.

11. Compare to natural forests, the species evenness and species diversity in artificial forests are (A) low low (B) high high (C) high low (D) low high (E) none of the above.

12. Species with low biomass but large effects on community structure is called (A) abundant species (B) dominant species (C) exotic species (D) keystone species (E) model species.

13. Indicate the trophic level of phytoplankton (a), daphnia (b), jellyfish (c), sea turtle (d). (A) a-b-c-d (B) a-c-b-d (C) a-b-d-c (D) a-d-b-c (E) a-d-c-b.

14. Ecosystem changes during succession include increases in (A) biomass (B) primary production (C) respiration (D) nutrient retention (E) all of the above.

15. The highest species richness generally occurs in (A) high latitude (B) middle latitude (C) equator (D) arctic (E) antarctic.

16. _____ which destroys the climax stage, opens up space and reinitiates succession. (A) competition (B) predation (C) selection (D) disturbance (E) fragmentation.

17. Chi-square is a (A) facilitation model (B) specific place (C) statistic method (D) comparative method (E) none of the above.

18. _____ is a loss of responsiveness to stimuli that convey little or no information. (A) kinesis (B) taxis (C) habituation (D) cognition (E) foraging.

19. GPS is (A) global positioning systems (B) an effective tool for location search (C) using satellites as reference points (D) useful in geographic ecology (E) all of the above.

20. The concept of community is (A) same as population (B) the connections among organism (C) not related to environments (D) the

activities of certain organism

21. The internal environment of body is (A) the intracellular fluid. (B) the intracellular fluid and the interstitial fluid. (C) the extracellular fluid surrounding cells. (D) the blood plasma. (E) the glumerula filtrate.

22. Which of the following is not correct about pH? (A) pH is higher, the acidity is stronger. (B) $pH=-\log[H^+]$ (C) The pH value from seven changes to six, the hydrogen ion concentration increases ten times (D) pH of the neutral solution is equal to seven. (E) blood pH is in the lung is higher than that in the muscle.

23. Which type of cellular filament is formed by the tubulin? (A) microfilament. (B) microtubule. (C) intermediate filament. (D) muscle thick filament. (E) muscle thin filament.

24. What is the characteristic of Na/K-ATPase ? (A) It presents in all cell membrane. (B) It creates a lower intracellular potassium ion concentration than that of extracellular fluid. (C) Hydrolysis of one ATP molecule enables the transporter to move three sodium ions into the cell and two potassium ions outside the cell. (D) It is a kind of secondary active transport system. (E) All of the above.

25. Which of the following is an important pacemaker of biological rhythms? (A) suprachiasmatic nucleus. (B) pituitary gland. (C) hippocampus. (D) caudate nucleus. (E) corpus callosum.

26. Which of the following is not a neurotransmitter? (A) dopamine. (B) ATP. (C) glutamate. (D) tryptophan. (E) serotonin.

27. In the vestibular system, which of the following can detect the angular acceleration during rotation of the head? (A) cupula. (B) saccul. (C) semicircular ducts. (D) ampulla. (E) cochlear.

28. Between two cerebral hemispheres, there is a quite huge nerve fibrous bundle, that is: (A) hypothalamus. (B) hippocampus. (C) septal nuclei. (D) corpus callosum. (E) pons.

29. Muscle length-tension relationship is due to the difference of (A) the ATP supply. (B) the number of functional cross bridge. (C) the number of muscle fiber. (D) the frequency of nerve impulse. (E) All of the above.

30. How can the phagocyte carry on the intracellular killing, (A) enzymes in the phagosome produce hydrogen peroxide. (B) phagosome produce hydrolitic enzyme. (C) enzymes in the phagolysosome produce nitric oxide. (D) phagosome produce opsonin. (E) All of the above.

31. Light in plants is (A) as the energy for photosynthesis via the priming absorbing pigment, carotenoid, (B) not associated with leaf development (C) is not related to dormancy (D) can be sensed by phytochrome (E) not related to seed germination

32. CO_2 is the source of carbon fixation, therefore, (A) used by Calvin cycle in the form of HCO_3^-, (B) 3-PGA as the first product for the C4 pathway, (C) is supported by photophosphorylation, (D) is not related to cell wall synthesis, (E) more CO_2, more products.

33. In response to stressful environments, higher plants (A) develop defense mechanisms, (B) can not avoid it because they can not escape, (C) escape by movement, (D) under dormancy, (E) only die

34. Inorganic nutrient is essential for plant, so they utilize nutrient by (A) uptake via transporters, (B) vesicles, (C) can not be stored as inorganic form after uptake, (D) the assimilation without coupling of photosynthetic energy, (E) by endocytosis.

35. Algae are (A) plants, (B) the organism dependent on light as energy source only, (C) can not observed in the air, (D) the eukaryotic characteristics, (E) the organism that can not uptake ions.

Assay questions (30%)

1. Design a planetary ecosystem based entirely on chemosynthesis. 10%
2. The action potential in neuron is an "all-or-none" firing pattern, explain why? 10%
3. Explain the evolution of photosynthetic organism. 10%

3 points each for questions 1-33, 1 point for question 34, Answer only on Answering booklet

Please answer Questions 1 - 9 based on the abstract of a paper in the following.

Jablonski D, Roy K, Valentine JW (2006) Out of the tropics: Evolutionary dynamics of the latitudinal diversity gradient. Science 314: 102-106

The evolutionary dynamics underlying the latitudinal gradient in biodiversity have been controversial for over a century. Using a spatially explicit approach that incorporates not only origination and extinction but immigration, a global analysis of genera and subgenera of marine bivalves over the past 11 million years supports an "out of the tropics" model, in which taxa preferentially originate in the tropics and expand toward the poles without losing their tropical presence. The tropics are thus both a cradle and a museum of biodiversity, contrary to the conceptual dichotomy dominant since 1974; a tropical diversity crisis would thus have profound evolutionary effects at all latitudes.

1. Where was the paper published? a) South America b) Tropics c) north or south poles d) Science e) a museum
2. When was the paper published? a) 11 millions ago b) 2006 c) 314 d) 2008 e) 1974
3. How many authors are responsible for this research? a)1 b) 2 c) 3 d) 4 e) >4
4. Which term is least related to this research? a) migration b) species diversity c) global pattern d) millionaire e) mollusk
5. Inferring from the study, more species are expected to originate from a) Alaska b) Australia c) Indonesia d) New Zealand e)Iceland
6. Implicit in the abstract is that high diversity occurs in a) high altitude b) low altitude c) high latitude d) low latitude e) none above
7. *"out of the tropics"* model most likely states that many species a) originates inside the tropics b) originates outside of tropics c) went extinct inside the tropics d) went extinct outside the tropics e) went extinct if they move
8. According to the abstract, the extinction rate is a) high in the tropics b) high in the poles c) high in marine bivalves d) high before 1974 e) none above
9. The full paper of this published work occupies a) 1 b) 2 c) 3 d) 4 e) >4 pages

Please answer Questions 10 - 16 based on the abstract of a paper in the following.

Howard EC, Henriksen JR, Buchan A, Reisch CR, Buergmann H, Welsh R, Ye WY, Gonzalez JM, Mace K, Joye SB, Kiene RP, Whitman WB, Moran MA (2006) Bacterial taxa that limit sulfur flux from the ocean. Science 314: 649-652

Flux of dimethylsulfide (DMS) from ocean surface waters is the predominant natural source of sulfur to the atmosphere and influences climate by aerosol formation. Marine bacterioplankton regulate sulfur flux by converting the precursor dimethylsulfoniopropionate (DMSP) either to DMS or to sulfur compounds that are not climatically active. Through the discovery of a glycine cleavage T-family protein with DMSP methyltransferase activity, marine bacterioplankton in the Roseobacter and SAR11 taxa were identified as

primary mediators of DMSP demethylation to methylmercaptopropionate. One-third of surface ocean bacteria harbor a DMSP demethylase homolog and thereby route a substantial fraction of global marine primary production away from DMS formation and into the marine microbial food web.

10. According to the above study, which climate parameter is most closely related to bacterioplankton in the sea a) rain fall b) glaciation c) global warming d) lightening e) seasonal fluctuation of temperature
11. Methylmercaptopropionate is a) climatically active b) not climatically active c) irrelevant d) toxic to bacteria e) toxic to plankton
12. Taxonomically, the target organisms of this study is a) aerosol b) sulfur c) bacteria d) marine plankton e) enzyme and protein
13. Which of the following is likely to end up in the air a) DMS b) DMSP c)glycine d) DMSP methyltransferase and homologs e) methylmercaptopropionate
14. Which of the following about Roseobacter and SAR11 taxa is WRONG a) they live in the sea b) they are small c) they have *glycine cleavage T-family protein* d) the more abundant they are, the more aerosol formation in the air e) they are active only when alive
15. Dimethylsulfide does not contain a) C b) H c) O d) S
16. According to this study, if we eliminate all bacterioplankton, the amount atmospheric aerosol should a) increase b) decrease c) remain unchanged d) unclear

Please answer Questions 17 - 23 based on the abstract of a paper in the following.

Hsieh CH, Reiss CS, Hunter JR, Beddington JR, May RM, Sugihara G (2006) Fishing elevates variability in the abundance of exploited species. Nature 443: 859-862

The separation of the effects of environmental variability from the impacts of fishing has been elusive, but is essential for sound fisheries management(1-7). We distinguish environmental effects from fishing effects by comparing the temporal variability of exploited versus unexploited fish stocks living in the same environments. Using the unique suite of 50-year-long larval fish surveys from the California Cooperative Oceanic Fisheries Investigations(4) we analyse fishing as a treatment effect in a long-term ecological experiment. Here we present evidence from the marine environment that exploited species exhibit higher temporal variability in abundance than unexploited species. This remains true after accounting for life-history effects, abundance, ecological traits and phylogeny. The increased variability of exploited populations is probably caused by fishery-induced truncation of the age structure, which reduces the capacity of populations to buffer environmental events(1,5,8,9). Therefore, to avoid collapse, fisheries must be managed not only to sustain the total viable biomass but also to prevent the significant truncation of age structure(1,5,8,9). The double jeopardy of fishing to potentially deplete stock sizes and, more immediately, to amplify the peaks and valleys of population variability(7), calls for a precautionary management approach(10,11).

17. The numbers in parentheses are referring to a) page numbers b) figures c) tables d) figures and tables e) references in the original full text.

18. The original fish data used in this analysis is collected from a) satellite images b) DNA analyses c) scientific expeditions d) fishing companies e) fish market
19. Higher variation in a) fish size b) fish age c) fish abundance d) fish price is expected in exploited than in unexploited species.
20. Higher variation among a) fishing areas b) fishing years c) fishing fleets d) fishing methods e) fishing experience is expected in exploited species than in unexploited species.
21. In the phrase "to avoid collapse", means collapse of a) fish price b) fish market c) fish population d) fishing company e) fishing boats
22. The data analyzed is for fishes in a) the Pacific b) the Atlantic c) the Indian Ocean d) rivers and streams
23. The authors must be expert in a) sailing b) fishing c) statistics d) satellite data e) DNA analysis

Please answer Questions 24 -28 based on the abstract of a paper in the following.

Gess RW, Coates MI, Rubidge BS (2006) A lamprey from the Devonian period of South Africa. Nature 443: 981-984

Lampreys are the most scientifically accessible of the remaining jawless vertebrates, but their evolutionary history is obscure. In contrast to the rich fossil record of armoured jawless fishes, all of which date from the Devonian period and earlier(1-3), only two Palaeozoic lampreys have been recorded, both from the Carboniferous period(1). In addition to these, the recent report of an exquisitely preserved Lower Cretaceous example(4) demonstrates that anatomically modern lampreys were present by the late Mesozoic era. Here we report a marine/ estuarine fossil lamprey from the Famennian (Late Devonian) of South Africa(5,6), the identity of which is established easily because many of the key specializations of modern forms are already in place. These specializations include the first evidence of a large oral disc, the first direct evidence of circumoral teeth and a well preserved branchial basket. This small agnathan, Priscomyzon riniensis gen. et sp. nov., is not only more conventionally lamprey-like than other Palaeozoic examples(7,8), but is also some 35 million years older. This finding is evidence that agnathans close to modern lampreys had evolved before the end of the Devonian period. In this light, lampreys as a whole appear all the more remarkable: ancient specialists that have persisted as such and survived a subsequent 360 million years.

24. The sequence of geological periods, from old to young, is a) Devonian-Carboniferous- Cretaceous b) Carboniferous-Devonian-Cretaceous c) Devonian-Cretaceous-Carboniferous d) Carboniferous-Cretaceous-Devonian e) Cretaceous-Devonian-Carboniferous f) Cretaceous-Carboniferous-Devonian
25. According to the essay above, lampreys are a) an agnathan b) an armoured jawless fish c) ancestors of fishes d) ancestors of terrestrial vertebrates e) ancestors of all vertebrates
26. The critical evidence of this study was found in a) a fish market b) a marine expedition c) DNA analyses d) a fossil e) a fish tank

27. Lampreys a) only exist in fossils b) only exist in living organisms c) could be found both in fossils and living in the sea
28. Which is in Mesozoic a) Cretaceous b)Devonian c) Carboniferous d) Famennian e) Paleozoic

Please answer Questions 29-33 based on the abstract of a paper in the following.

Marean CW, Bar-Matthews M, Bernatchez J, Fisher E, Goldberg P, Herries AIR, Jacobs Z, Jerardino A, Karkanas P, Minichillo T, Nilssen PJ, Thompson E, Watts I, Williams HM (2007) Early human use of marine resources and pigment in South Africa during the Middle Pleistocene. Nature 449: 905-U911

Genetic and anatomical evidence suggests that Homo sapiens arose in Africa between 200 and 100 thousand years (kyr) ago(1,2), and recent evidence indicates symbolic behaviour may have appeared similar to 135-75 kyr ago(3,4). From 195-130 kyr ago, the world was in a fluctuating but predominantly glacial stage (marine isotope stage MIS6)(5); much of Africa was cooler and drier, and dated archaeological sites are rare(6,7). Here we show that by similar to 164 kyr ago (+/-12 kyr) at Pinnacle Point (on the south coast of South Africa) humans expanded their diet to include marine resources, perhaps as a response to these harsh environmental conditions. The earliest previous evidence for human use of marine resources and coastal habitats was dated to 125 kyr ago(8,9). Coincident with this diet and habitat expansion is an early use and modification of pigment, probably for symbolic behaviour, as well as the production of bladelet stone tool technology, previously dated to post-70 kyr ago(10-12). Shellfish may have been crucial to the survival of these early humans as they expanded their home ranges to include coastlines and followed the shifting position of the coast when sea level fluctuated over the length of MIS6.

29. According to the abstract above, what kind of evidence suggests that humans expanded their diet to include marine resources? a) genetic b) anatomical c) climate d) MIS6 e) none above
30. It may be inferred from above that chimpanzees' diet a) include marine resources b) does not include marine resources c) include shellfish d) include human e) include land animals
31. The authors found that humans first used marine resources a) 195 kyr ago b) when Africa was warm and humid c) there are many dated archaeological sites d) they used pigments for symbolic behavior e) none above
32. Similar evidence should be available in a) North America b) South America c) Australia d) Taiwan e) None above
33. The marine resource first used by humans may be a) mollusk b) fish c) whale d) macroalgae e) microalgae

34. Write one word that could be a common keyword to all 5 abstracts in this test. (in the answering sheet)