Part 1: Multiple choice (choose one best answer; 2 points each) ※ 注意：請於試卷內之「選擇題作答區」依序作答。

1. Which of the following statements about evolutionary history is true?
   a. A gigantic impact crater off the coast of the Yucatán Peninsula did not support the hypothesis that dinosaurs could be wiped out by asteroids.
   b. Studies in comparative morphology suggest that emus, ostriches, and rheas descended from different ancestors.
   c. Mass extinction events happened several times in Earth's history, not just 65.5 million years ago.
   d. All of the above

2. Which of the following statements about natural selection or artificial selection is not true?
   a. Natural selection is known as the "survival of the fittest".
   b. Humans can breed plants and animals through the process of artificial selection.
   c. Broccoli, cabbage, and cauliflower are a result of artificial selection on three different plant species.
   d. During his voyage around the globe, Darwin found many unusual fossils and diverse species, both of which helped him develop the concept of evolution driven by natural selection.

3. If there are 10 individuals of *Neofelis nebulosa brachyura* (Formosan clouded leopard) left in Taiwan, they will likely face the events listed below, except for __.
   a. genetic drift
   b. limited gene flow
   c. bottleneck effect
   d. inbreeding effect
   e. parapatric speciation

4. Which statement about systematics is true?
   a. A clade is a group including a common ancestor and all the descendants.
   b. Molecular systematic has its limitation because it cannot be easily applied to fossil record.
   c. All protists together cannot form a clade.
   d. All reptiles cannot form a single clade.
   e. All of the above.

5. There are protists (P), bryophytes (B), seedless vascular plants (S), gymnosperms (G), and angiosperms (A). Their appearance in the history of evolution should be (from early to late):
   a. P B S G A
   b. P S B G A
   c. P B G S A
   d. B P S G A
   e. B S P G A

6. Which statement about protists is not true?
   a. Protists are eukaryotes that are not fungi, plants, or animals.
   b. Protists have been used to make biofuel in the modern world.
   c. Protists' reproduction usually goes through a diploid-dominant cycle, just like animals.
   d. Protists may be photosynthetic or heterotrophic.

7. Which information about algal blooms will be incorrect?
   a. Algal blooms can lead to red or brown tides.
   b. Algal blooms are often associated with human disturbance on water quality.
   c. The frequency of marine algal blooms has decreased globally.
   d. Red or brown tides are often correlated with the release of toxic compounds.
   e. Bacteria feeing on algal remains can use up oxygen, so that aquatic animal suffocate.

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8. Which statement is false?
   a. Bryophytes put the most energy into making gametophytes. However, vascular plants invest more in making sporophytes.
   b. Bryophytes develop xylems to transfer water and support their stems.
   c. The traits of bryophytes show a transition between protists and vascular plants. For example, both protists and bryophytes may have chloroplasts, and both bryophytes and vascular plants have the retention of multicellular diploid embryo.
   d. Bryophytes may reproduce sexually or asexually (e.g. fragmentation, gemmae).
   e. Bryophytes don't have real leaves and roots, compared to vascular plants.

9. Which statement about vascular plants is not true?
   a. The leaves of vascular plants can be classified as microphyll or megaphyll.
   b. Vascular plants have dermal, vascular, and ground tissue systems.
   c. The secondary growth in vascular plants is basically due to the growth of apical meristems.
   d. Vascular plants usually go through an alternation of heteromorphic generations.
   e. There are water ferns in Taiwan.

10. You are asked to cook a meal with seedless vascular plants for an Ecology and Evolutionary Biology party. Which one below should you choose?
   a. Kelp 海帶
   b. Pineapple
   c. *Asplenium* 山蘇
   d. Mushroom
   e. Cabbage

11. Which statement best describes seed plants?
   a. Seed plants include both gymnosperm and angiosperm.
   b. Compared to seedless plants, seed plants produce less protected embryos.
   c. Seed plants have megaspores, but no microspores.
   d. Micropyle will develop into seed coat to protect a seed.
   e. All of the above

12. The native cycads (蘇鐵) in Taiwan is threatened by exotic cycads. What is the major reason?
   a. Exotic cycads invade the native one's habitat (i.e. 台東).
   b. Exotic cycads secrete chemical to soil and then kill the native one.
   c. Exotic cycads attract pollinators away from the native one.
   d. Exotic cycads support high populations of herbivores, which hurt the native cycad.

13. Which statement about angiosperms is true?
   a. Angiosperms have more than 300000 species and are currently the most dominant group of plants.
   b. Angiosperms are also called eudicots.
   c. Flowers produce nectar in order to attract herbivores.
   d. The position of ovary has not changed over the evolutionary history of flowers.
   e. All of the above

14. Which statement about angiosperms is true?
   a. Blueberries, strawberries, and pineapples are simple, aggregate, and multiple fruits, respectively.
   b. Angiosperms may develop advanced chemicals (secondary metabolites) against herbivores.
   c. Some herbivores may in turn use plant chemicals to protect themselves from predators.
   d. Angiosperms may use abiotic (e.g. wind) or biotic (e.g. animals) agents to help disperse seeds.
   e. All of the above

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15. Which of the following is not a macronutrient?
    a. Iron
    b. Nitrogen
    c. Phosphorus
    d. Potassium
    e. All of the above

16. Which statement about nutrient cycles is not true?
    a. Earth is basically a closed system, and therefore life on Earth depends on the recycling of elements.
    b. Nitrogen gas makes up about 78% of our atmosphere. Therefore, nitrogen is usually not a limiting factor in plant growth.
    c. The most common nitrogen-fixing bacteria often form symbiotic relationships with the roots of legumes.
    d. Nitrogen can be lost from a local ecosystem by the harvesting of plants, by soil erosion, or by leaching.
    e. Industrial nitrogen fixation facilitates agricultural development but also creates environmental problems (e.g. eutrophication due to excessive fertilization).

17. Which statement about water movement in plants is not true?
    a. Plants may lose 90% of water they absorb due to transpiration.
    b. Plants lose most of their water through stomata.
    c. Plants use water less efficiently than animals in general.
    d. Cuticle maximizes plants' water loss.
    e. CAM plants close their stomata during daytime to reduce transpiration.

18. Which statement about vascular plants is true?
    a. They have primary growth, but no secondary growth.
    b. Tracheary elements are the conducting cells of the phloem.
    c. Vascular plants' reproduction system is oogamous.
    d. In vascular plants, the gametophyte is larger and more complex than the sporophyte.
    e. All of the above

19. Which statement can describe the current status of global agriculture?
    a. Coffee and tea are among the most important drinks in the world.
    b. Six major food crops include wheat, rice, corn, potatoes, sweet potatoes, and manioc.
    c. When we face global environmental change, it is important to preserve the genetic diversity of crop plants.
    d. All of the above

20. Which statement about ecology is not true?
    a. Ecology studies organism-organism or organism-environment relations.
    b. Plants can sequester a lot of excessive carbon produced by human activity.
    c. The world is green because predators can control herbivores, and also because plants have defenses against herbivores.
    d. Taiwan's ecosystems are rarely affected by invasive species, since Taiwan is isolated from other counties.

21. If you become a leader in Taiwan, what information about global ecology/climate change can you tell your people?
    a. Taiwan is lucky because land at similar latitudes around the world is often covered by desert or savannas.
    b. Taiwan's ecosystems have very high biodiversity, compared to the majority of countries in the world.
    c. Species under climate change (i.e. warming) may have to move to higher elevations in Taiwan.
    d. All of the above

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22. Which of the following statements regarding a common cellular activity is false?
    a. Cells respond to the environment.
    b. Cells develop and maintain complex organization.
    c. Cells regulate their internal environment in an effort to maintain homeostasis.
    d. New cells are derived from cellular components like organelles.

23. A community
    a. includes all populations of species in an area.
    b. features the living organisms interacting with the physical and chemical environment.
    c. is the sum of all places in Earth's atmosphere, crust, and waters where organisms live.
    d. includes members of only one species.

24. An adaptive trait is a trait that has
    a. Been created by an organism in response to an environmental change
    b. survival and reproduction value
    c. decreased in frequency in a population.
    d. the potential to produce variation.

25. An individual's fitness is:
    a. The number of calories it can burn per minute
    b. How far it can run per minute
    c. How likely it is to win a fight
    d. The number of progeny

26. Two poisonous species of moths that live in overlapping habitats have a similar coloration. This is an example of:
    a. Mullerian mimicry
    b. Batesian mimicry
    c. Protective coloration
    d. Imitation

27. When physicians perform an organ transplant, they choose a donor whose tissues match those of the recipient as closely as possible. Which of the following cell components are being matched?
    a. plasma membrane phospholipids
    b. plasma membrane transport proteins
    c. cell-surface glycolipids and glcoproteins
    d. plasma membrane cholesterols

28. Which of the following is a typical feature of an ATP-driven active transport mechanism?
    a. The transport protein must cross to the correct side of the membrane before the solute can bind to it.
    b. The transport protein is irreversibly phosphorylated as transport takes place.
    c. The transport protein catalyzes the conversion of ADP to ATP.
    d. The transport protein must be phophorylated to move the solute against the concentration gradient.

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29. Which of the following events does not occur in prophase II but does occur in prophase I?
    a. crossing over
    b. pairing of homologues
    c. spindle formation
    d. crossing over and pairing of homologues only

30. If a mixture of bacteriophages, some labeled with radioactive sulfur and others labeled with radioactive phosphorus, is placed in a bacterial culture, the bacteria will eventually contain
    a. radioactive sulfur.
    b. radioactive phosphorus.
    c. both radioactive sulfur and phosphorus.
    d. neither radioactive sulfur nor radioactive phosphorus.

31. If all of the hydrogen bonds in a DNA molecule were to break,
    a. the nucleotide base pairs would separate from each other.
    b. the phosphate groups would separate from the deoxyribose sugars.
    c. the deoxyribose sugars would separate from the nitrogen-containing bases.
    d. the molecule would unwind, but the two strands would stay together.

32. An example of a disease that is caused by your immune system attacking parts of your own body:
    a. malaria
    b. sleeping sickness
    c. HIV/AIDS
    d. Multiple sclerosis

33. After a chemical signal is received by the dendrites of a neuron, it then travels through
    a. the cell body as a chemical signal
    b. the synapse as a chemical signal
    c. the axon as an electric signal
    d. the cell body as an electric signal

34. The property of photoreceptor cells that makes the outer edges of objects appear more distinct is:
    a. Lateral inhibition
    b. Photoreception
    c. Natural selection
    d. Polygenic inheritance

35. Which of the following will help establish a salt concentration gradient in the kidneys?
    a. glomerulus
    b. Bowman's capsule
    c. proximal tubule
    d. Loop of Henle

36. Which of the following is not produced by the anterior pituitary?
    a. GH
    b. ADH
    c. MSH
    d. Prolactin

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37. A term which describes some female animals that can lay eggs which will later develop and grow into an individual without being fertilized.
    a. biogenesis
    b. hermaphrodism
    c. parthenogenesis
    d. budding

38. Which of the following are signals intended for conspecifics?
    a. Hormones
    b. Pheromones
    c. Allomones
    d. Kairomones

39. The middle ear bone that transmits vibrations to the oval window.
    a. stapes
    b. incus
    c. malleus
    d. tympany

40. A healthy human can hear what range of frequencies in Hz?
    a. 20 – 5,00
    b. 20 - 2,000
    c. 20 – 5,000
    d. 20 - 20,000

41. Selective breeding to reduce the frequency of an undesirable rare recessive trait in domestic species is very difficult unless:
    a. The chromosomal location of the gene has been identified.
    b. Heterozygotes can be identified.
    c. Phenotypic evidence of the trait can be surgically removed.
    d. Artificial insemination is widespread.

42. An X-linked recessive gene produces a red-green color-blindness in human. A woman with normal vision whose father was color-blind married to a color-blind man. What is the probability that their first child of this marriage will be a color-blind boy?
    a. 0.25
    b. 0.5
    c. 0.75
    d. 1

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43. Species extinction rates are higher on small islands than larger islands because:
    a. Small islands are usually further from the mainland.
    b. Small islands are harder for dispersers to find.
    c. Average population sizes are smaller on small islands.
    d. Evolution occurs faster on small islands.

44. Sexual reproduction is most likely to be seen in:
    a. Extreme altitudes
    b. Unstable environments
    c. Competitive environments
    d. Early colonizers

45. In a diploid population, your degree of relatedness to your first cousin is:
    a. 0.0625
    b. 0.125
    c. 0.25
    d. 0.5

46. Marginal Value Theory predicts:
    a. The optimal time to spend at a food patch before leaving in search of a fresh patch
    b. When an animal should eat a less profitable food and when it should pass up the less profitable item to keep searching for a more profitable, but scarce food item
    c. When an animal should act aggressively
    d. The optimal search time for a food patch

Part 2: Short Answer ※ 注意：請於試卷內之「非選擇題作答區」作答，並應註明作答之題號。

1. What plant traits will you measure in order to demonstrate the impact of environmental change on plant growth or community? Why these traits? (8 points)

試題隨卷繳回