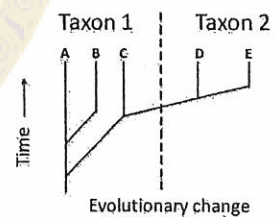


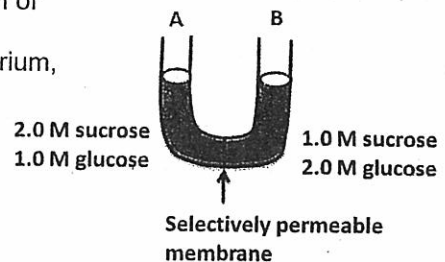
I. 單選題 (每題 2 分，共 70 分) (請依題號順序於選擇題作答區內作答)
(select the BEST answer)

1. Plant photosynthesis produces two substances essential to the existence of most organisms (e.g. animals):
A. oxygen and water. B. sugar and nitrogen. C. sugar and water. D. sugar and oxygen.
2. Protoplast does not include _____.
A. cytoplasm B. nucleus C. ribosomes D. cell wall
3. The principal plastids involved in photosynthesis are the _____.
A. etioplasts B. chromoplasts C. leucoplasts D. chloroplasts
4. Which pigment occurs in all photosynthetic eukaryotes?
A. Chlorophyll a C. Chlorophyll c
B. Chlorophyll b D. Chlorobium chlorophyll
5. Which of the following events is not associated with Photosystem I?
A. Absorption of light by antenna molecules
B. Excitation of an electron from P700
C. Water molecules are split into electrons, protons, and oxygen.
D. Reduction of NADP⁺
6. If a population of a species (e.g. Happy Bird) evolves and becomes a new species (e.g. Angry Bird) due to geographical isolation (e.g. mountain barriers), this process will be called _____.
A. allopatric speciation C. artificial speciation
B. sympatric speciation D. hybrid speciation
7. Which of the following statements about systematics is not true?
A. *Viola tricolor* var. *tricolor* and *Viola tricolor* var. *hortensis* are the same species of plants.
B. Charles Darwin created the binominal system.
C. The scientific study of biological diversity and its evolutionary history is called systematics.
D. Taxonomy is the identifying, naming, and classifying of species.
8. Which statement about systematics is true?
A. Convergent evolution means the similarity of closely related species.
B. Molecular systematics can be easily applied to fossil record.
C. Taxon 1 (see figure) is not a clade since a clade is composed of an ancestor and all its descendants.
D. Three domains of life mean Minerals, Archaea, and Eukarya.
9. Which statement about Eukaryotes is true?
A. Most vascular plants go through zygotic meiosis.
B. The serial endosymbiotic theory explains how mitochondria and chloroplasts got into Eukaryotic cells.
C. An endosymbiont is an organism that lives within a nonliving substance.
D. Eukaryotic domain has three Kingdoms in total: Fungi, Protista, and Animalia.
10. Which information about fungi is not true?
A. Fungi can form symbiotic relationships with plants, insects, or algae.
B. Mycorrhizae can increase plants' ability to capture water and essential elements.
C. Most fungi are composed of hyphae and their cell wall is made of chitin.
D. Fungi have a low surface-to-volume ratio and hence insensitive to environmental change.
11. 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 xylem.
C. The gamete form of vascular plants is isogamy.
D. In vascular plants, the gametophyte is larger and more complex than the sporophyte.



12. What information about algae is true?
A. Algae are important primary producers and can provide shelter to marine organisms.
B. Algae can be used as human food, fertilizer, or thickening agents.
C. Algal blooms may lead to red or brown tides, which are often correlated with the release of toxic compounds.
D. All of the above
13. Which information is not true?
A. Bryophytes can be used in horticulture as a packing material for plant roots.
B. Both bryophytes and vascular plants have xylem and phloem.
C. Bryophytes' sporophyte is unbranched.
D. Bryophytes can undergo asexual reproduction via fragmentation or the production of gemmae.
14. Which statement about seed plants is true?
A. Seed plants include both gymnosperm and angiosperm.
B. Angiosperms are currently the most dominant group of plants.
C. The native cycads in Taiwan are in danger.
D. All of the above
15. The long-distance transport of sap in the phloem is best explained by _____.
A. simple diffusion B. facilitated diffusion C. pressure-driven bulk flow D. exocytosis
16. In peas, green pod color is dominant over yellow pod color. If a plant heterozygous for pod color is crossed with a plant homozygous recessive for pod color, what phenotypes would you expect in the offspring?
A. All with green pods
B. Half with green pods and half with yellow pods
C. Three-quarters with green pods and 1/4 with yellow pods
D. One-quarter with green pods and 3/4 with yellow pods
17. In a eudicot stem, _____ is the ground tissue external to the system of vascular strands and _____ is the ground tissue internal to these strands.
A. pith; cortex B. cortex; pith C. xylem; phloem D. pith; phloem
18. Which of the following statements about plant roots is false?
A. The root system in monocots is generally shallower than that in eudicots.
B. The two primary functions of roots are anchorage and absorption.
C. The roots of eudicots usually form a fibrous root system.
D. The main root system of monocots develops from roots arising from the stem.
19. What is not true about agricultural development?
A. The domestication of plants can be traced back to 10,500 years ago in the Fertile Crescent of the eastern Mediterranean.
B. The earliest domestication of plants in Asia included cotton and potato.
C. Manioc can be used to make Tapioca. In recent years, Taiwanese Tapioca Tea has gained popularity around the world.
D. When we face global environmental change, it is important to preserve the genetic diversity of crop plants.
20. Which of the following is not a macronutrient for most vascular plants?
A. Nitrogen B. Iron C. Phosphorus D. All of the above
21. Which of the following statements about a biome is false?
A. It has distinctive vegetation.
B. It may occupy a large area of land surface.
C. It is mainly controlled by climate.
D. It is usually limited to a single continent.
22. Chinese white dolphins (*Sousa chinensis*; 中華白海豚) are facing strong anthropogenic impacts. Their population in Taiwan is estimated at around _____ individual(s).
A. 1 B. 100 C. 1000 D. 10000

23. 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. The most common nitrogen-fixing bacteria often form symbiotic relationships with the roots of legumes.
 C. Nitrogen gas makes up about 78% of our atmosphere. Therefore, nitrogen is usually not a limiting factor in plant growth.
 D. Nitrogen can be lost from a local ecosystem by the harvesting of plants, by soil erosion, or by leaching.
24. Which statement about trophic structure and ecosystems is not true?
 A. Energy flow in ecosystems often follows the pattern of "pyramid of energy".
 B. DDT concentration reached the highest in top predators (e.g. eagles), reducing these predators' population.
 C. Higher species diversity often leads to higher ecosystem functions.
 D. Taiwan's ecosystems are rarely affected by invasive species, since Taiwan is isolated from other countries.
25. If you become a leader in Taiwan, what correct information about global/climate change ecology 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 has diverse biomes.
 C. Species under climate change may move to higher elevations in Taiwan.
 D. All of the above
26. Resolving power of a microscope is
 A. the distance between two separate points. C. the degree of magnification of an image
 B. the sharpness or clarity of an image D. the wavelength of light
27. Which of the following is not a similarity among the nucleus, chloroplasts, and mitochondria?
 A. They contain DNA.
 B. They are bounded by a double phospholipid bilayer membrane.
 C. They are derived from the endoplasmic reticulum system.
 D. They can divide to reproduce themselves.
28. In which cell would you expect to find the most tight junctions?
 A. muscle cell in the leg muscle of a long-distance runner
 B. pancreatic cell that manufactures digestive enzymes
 C. macrophage (white blood cell) that engulfs bacteria
 D. epithelial cell lining the digestive tract
29. The solutions in the two arms of a U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is filled with a solution of 2.0 M sucrose and 1.0 M glucose. Side B is filled with 1.0 M sucrose and 2.0 M glucose. After the system reaches equilibrium, what changes are observed?
 A. The water level is higher in side A than in side B.
 B. The water level is higher in side B than in side A.
 C. The molarity of glucose is higher in side A than in side B.
 D. The molarity of sucrose has increased in side A.



32. Which of the following reactions is correctly paired with its location?
- ATP synthesis / inner membrane of the mitochondrion
 - glycolysis / cell cytosol
 - substrate-level phosphorylation / cytosol and matrix
 - Krebs cycle / cristae of mitochondrion
33. In the polymerization of DNA, a phosphodiester bond is formed between a phosphate group of the nucleotide being added and _____ of the last nucleotide in the polymer.
- the 5' phosphate
 - C₆
 - the 3' OH
 - a nitrogen from the nitrogen-containing base
34. Knockout mice have been genetically altered to knock out specific genes. How are these mice most often used in research?
- to study DNA replication in the defective genes (those that have been altered)
 - to determine the role of proteins coded for by those genes that are knocked out
 - to examine defects in DNA structure in those regions that have been altered
 - to study the effect of radiation on DNA
35. How might a single base substitution in the sequence of a gene affect the amino acid sequence of a protein encoded by the gene, and why?
- Only a single amino acid could change, because the reading frame is unaffected.
 - The amino acid sequence would be substantially altered, because the reading frame would change with a single base substitution.
 - All amino acids following the substitution would be affected, because the reading frame would be shifted.
 - It is not possible for a single base substitution to affect protein structure, because each codon is three bases long.

II. 解釋名詞 (每題 3 分，共 15 分) (請標明題號，於非選擇題作答區內作答)

- telomere
- genomics
- Bohr shift
- gastrin
- major histocompatibility complex (MHC)

III. 簡答題 (每題 5 分，共 15 分) (請標明題號，於非選擇題作答區內作答)

- 脊椎動物的循環系統最重要的生理功能為何? 魚類擁有單循環(single circuit)的系統，其他脊椎動物則演化出雙循環(double circuit)的系統。請問雙循環有何好處，使得大多數的脊椎動物均具有此類型的循環方式?
- 某人於短時間內喝下大量的蒸餾水，50 分鐘後進行檢測。請問(A)其血液中的抗利尿激素濃度(與喝水前比較)有何變化? (B)其腎元(nephron)的哪一段管道(近端腎小管、亨氏管的底部、遠端腎小管、髓質集尿管)具有濃度最高的濾液(尿液)? 為甚麼?
- 神經系統讓我們能對外界的多種刺激產生知覺，並做出適當的反應。請問我們的大腦如何分辨嗅覺(smell)和味覺(taste)的不同?