

I. 單選題 (每題 1.5 分，共 45 分) (請依序作答於答案卷首頁之選擇題作答區)

1. Fungi are ecologically important because of all of the following except

- A) they break down organic material and return them to the ecosystem.
- B) all can exist in symbiotic relationships.
- C) some can ferment and produce bread, beer, wine, cheese, and soy sauce.
- D) some cause diseases in plants and animals.
- E) they can break down lignin.

2. Nuclear pores apparently permit the passage of only

- A) chromosomes outward.
- B) glucose molecules outward.
- C) assembled DNA molecules outward.
- D) proteins inward and outward, but RNA only outward.
- E) sodium ions inward, potassium ions outward.

3. What is a distinctive characteristic of monocot stems compared to dicot ones?

- A) The ground tissue is arranged in concentric rings.
- B) The vascular cambium is divided into segments.
- C) The vascular bundles are scattered throughout the ground tissue.
- D) The xylem and phloem are located in separate vascular bundles.
- E) The epidermis surrounds the ground tissue.

4. Fertilization in angiosperms leads to the formation of a diploid zygote and the typically triploid primary

- A) endosperm nucleus.
- B) seed.
- C) ovule.
- D) ovary.
- E) carpel.

5. You are working to isolate pigments from a cyanobacteria species recovered from the ocean floor. Which of the following would you most likely expect to find?

- A) chlorophyll *a*
- B) chlorophyll *b*
- C) phycobiloproteins
- D) carotenoids
- E) flavonoid

6. The photosynthetic electron transport causes the accumulation of protons in which part of the chloroplast?

- A) matrix
- B) stroma
- C) envelope
- D) outer membrane
- E) internal thylakoid space

7. Chemiosmotic generation of ATP is driven by

- A) osmosis of macromolecules.
- B) the Na⁺/K⁺ pump.
- C) large quantities of ADP.
- D) P_i transfer through the plasma membrane.
- E) a difference in H⁺ concentration on the two sides of the mitochondrial membrane.

8. Most protein-enzymes are

- A) fibrous proteins.
- B) globular proteins.
- C) histones.
- D) metalloenzymes.
- E) hormones.

9. The connection between carrots and vision is that the β-carotene of carrots can produce two molecules of vitamin A and oxidation of vitamin A produces a pigment used in vertebrate vision. This pigment's name is

- A) chlorophyll.
- B) ferredoxin.
- C) cytochrome.
- D) carotene.
- E) retinal.

10. Archaea differ from Bacteria in all of the following except

- A) cell wall composition.
- B) plasma membrane make up.
- C) the presence of a nucleoid region.
- D) DNA replication.
- E) gene expression.

11. The marine multicellular protists including the larger brown algae belong to the
A) dinoflagellates. C) Stramenopiles. E) foraminifera.
B) Choanoflagellida. D) euglenoids.
12. Which of the following statements about phytochrome is not true?
A) It exists in two interconvertible forms. D) P_{FR} reverts to P_R in the dark.
B) P_R absorbs red light. E) Several versions of phytochrome exist with
C) P_{FR} is biologically inactive. overlapping but distinctive functions.
13. Which of the following is most limiting for plant growth, especially in relation to the plant's carbon uptake?
A) phosphorous B) potassium C) nitrogen D) calcium E) magnesium
14. Which of the following plant hormones plays a primary role in triggering K^+ to pass rapidly out of guard cells?
A) abscisic acid B) auxin C) indoleacetic acid D) ethylene E) gibberellic acid
15. The proteins that participate in the functioning of the checkpoints for cell cycle control are
A) microtubules. C) histones. E) channel proteins.
B) cyclins and cyclin-dependent kinases. D) asters.
16. Which of the following is an example of positive feedback?
A) An increase in blood sodium concentration increases the amount of aldosterone that increases the excretion of sodium in the urine.
B) A series of strong uterine contractions increase the amount of oxytocin that stimulates further uterine contractions.
C) A decrease in blood sugar concentration increases the amount of glucagon that converts glycogen to glucose.
D) An increase in calcium concentration increases the amount of calcitonin that stores calcium in bones.
E) An increase in body temperature increases the blood flow of the skin and sweating.
17. Taking vaccine help a person resists infection by a pathogen, it is because of
A) immunological memory D) innate immunity
B) an allergy E) immunological tolerance
C) an autoimmune response
18. If you observe vertebrate organisms with parthenogenetic reproduction, internal development of embryos, and the lack of parental care for its young, you should categorize these organisms as
A) earthworms. B) lizards. C) frogs. D) birds. E) mammals.
19. Why is the velocity of blood flow the lowest in capillaries?
A) The capillary walls are not thin enough to allow oxygen to exchange with the cells.
B) Blood flow slows as distance from the heart increases.
C) The blood pressure is too low to deliver blood to the capillaries at a high flow rate.
D) The total surface area of the capillaries is largest in the circulatory system.
E) The total cross-sectional area is much greater in capillaries than in the arteries or any other part of the circulatory system.

20. _____ is released by the duodenum in response to a chyme rich in fat.
A) gastrin B) pepsin C) leptin D) secretin E) cholecystokinin
21. Which of the following statements about vision in human is true?
A) Perception of visual information takes place in the thalamus.
B) Color vision results from the presence of three subclasses of cones in the retina, each with its unique type of retinal.
C) Cones are more light sensitive than rods and are responsible for night vision.
D) Visual acuity is sharpest in the fovea because the ganglion cells have a small receptor field.
E) All information from the left eye goes to the right visual cortex and all information from the right eye goes to the left visual cortex.
22. Ovulation is the follicular response to a burst of secretion of
A) LH. B) progesterone. C) inhibin. D) prolactin. E) estradiol.
23. Why is gas exchange more difficult for aquatic animals with gills than for terrestrial animals with lungs?
A) Water is less dense than air.
B) Water contains much less O₂ than air per unit volume.
C) Gills have less surface area than lungs.
D) Gills allow only unidirectional transport.
E) Gills allow water to flow in one direction.
24. The explanation for the differences between a cell from the human cardiac muscle and a cell from the skin is the
A) maternal and paternal origins of the cell types.
B) expression of the genes in the two cells.
C) fact that they are in different parts of the body.
D) gene content of the two cells.
E) the cell from the skin mutates quickly.
25. Which of the following ion and structure link the action potential and muscle contraction, so called excitation-contraction coupling?
A) Na⁺/T-tube D) Ca²⁺/sarcoplasmic reticulum
B) Na⁺/sarcomere E) Ca²⁺/mitochondria
C) Ca²⁺/ribosome
26. Every morning at the same time, Rick went into the den to feed his new tropical fish. After a few weeks, he noticed that the fish swam to the top of the tank when he entered the room. This is an example of
A) habituation. C) maturation. E) classical conditioning.
B) imprinting. D) operant conditioning.
27. Which of the following are important biotic factors that can affect the structure and organization of biological communities?
A) precipitation, wind D) temperature, water
B) nutrient availability, soil pH E) light intensity, seasonality
C) predation, competition

28. Natural selection has led to the evolution of diverse natural history strategies, which have in common
- A) many offspring per reproductive episode.
 - B) limitation only by density-independent limiting factors.
 - C) adaptation to stable environments.
 - D) maximum lifetime reproductive success.
 - E) relatively large offspring.
29. According to the logistic growth equation $dN/dt = r_{max}N(K - N)/K$,
- A) the number of individuals added per unit time is greatest when N is close to zero.
 - B) the per capita growth rate (r) increases as N approaches K .
 - C) population growth is zero when N equals K .
 - D) the population grows exponentially when K is small.
 - E) the birth rate (b) approaches zero as N approaches K .
30. In a tide pool, 15 species of invertebrates were reduced to eight after one species was removed. The species removed was likely a(n)
- A) community facilitator.
 - B) keystone species.
 - C) herbivore.
 - D) resource partitioner.
 - E) mutualistic organism.

II. 解釋名詞 (每題 3 分, 共 30 分) (於答案卷上作答時請標明題號)

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|-------------------------------------|--------------------------------------|
| 1. Nucleosome; centrosome | 6. excitatory postsynaptic potential |
| 2. Genetic drift; gene flow | 7. species diversity |
| 3. Thylakoid; cristae | 8. electrocardiogram |
| 4. Endospore; akinete | 9. ecological succession |
| 5. Apical meristem; ground meristem | 10. imprinting |

III. 簡答題 (25%) (於答案卷上作答時請標明題號)

1. Discuss the similarities and differences between thigmotropism and turgor movement. (6分)
2. What are some plant host responses that confer resistance to plant pathogen? (7分)
3. Acetylcholine can stimulate skeletal muscle contraction, but reduce the rate at which the heart pumps. How can a neurotransmitter trigger different responses in postsynaptic cells? (4分)
4. How does a shark maintain osmotic balance in seawater? (4分)
5. The introduction of exotic species to aquatic communities has shown that the species diversity reduces. Give an explanation for it. (4分)