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國立臺灣大學 111 學年度碩士班招生考試試題

科目： 普通生物學(A)

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請清楚標示題號並依序作答於試卷上

I. 單選題: (每題 2 分, 共 54 分) ※請作答於試卷內之「選擇題作答區」

1. The lowest level of biological organization that can survive and reproduce is the \_\_\_\_\_.  
A) DNA      B) proton      C) nucleus      D) cell      E) tissue
2. A group of organisms of the same species that live together in the same place make up a(n) \_\_\_\_\_.  
A) population      B) community      C) ecosystem      D) sample      E) biosphere
3. The algae used to make sushi rolls are classified as \_\_\_\_\_.  
A) bacteria      B) fungi      C) protists      D) animals      E) plants
4. Within an organism, all cells have the same \_\_\_\_\_, whereas different cell types contain different \_\_\_\_\_.  
A) RNA; genes      B) proteins; RNAs      C) RNAs; proteins      D) genes; RNAs      E) proteins; genes
5. Which of the following is the correct path in the endomembrane system followed by a protein, beginning with its site of synthesis in the rough ER.  
A) rough ER; smooth ER; Golgi apparatus; plasma membrane  
B) rough ER; vesicles; lysosomes; plasma membrane  
C) rough ER; smooth ER; lysosomes; plasma membrane  
D) rough ER; Golgi apparatus; smooth ER; plasma membrane  
E) rough ER; Golgi apparatus; vesicles; plasma membrane
6. The breakdown of hydrogen peroxide, a toxic substance, occurs in small, specialized membrane-bound organelles called \_\_\_\_\_.  
A) lysosomes      B) peroxisomes      C) glycosomes      D) phagosomes      E) glyoxysomes
7. Which of the following statements is true?  
A) The surface area/volume ratio increases when the total surface area of a cell increases.  
B) Aquaporins would be considered as peripheral proteins of the plasma membrane.  
C) The selective permeability of a cell membrane is due to glycolipids on the surface of the membrane.  
D) Fishes that live in extreme cold have membranes with a high proportion of unsaturated fatty acids.  
E) Membrane cholesterol function in animal cell membranes to store cellular energy.
8. HER2 is a receptor that is present at excessively high levels in some breast cancer cells. Herceptin is a protein that binds to HER2 and inhibits cell division. Herceptin may be an effective drug for breast cancer treatment under which of the following conditions?  
A) The patient lacks functional HER2 proteins.  
B) The patient has excessive levels of receptor for other growth factor (not HER2) in cancer cells.  
C) The patient's cancer cells have excessive levels of HER2.  
D) Injection of HER2 into the patient's cancer cells inhibits cell division.  
E) Injection of HER2 into the patient's cancer cell nuclei inhibits cell division.
9. What is the source of electrons for carbon fixation in plants?  
A) O<sub>2</sub>      B) CO<sub>2</sub>      C) H<sub>2</sub>O      D) H<sup>+</sup>      E) glucose
10. Where does photosynthesis take place in cyanobacteria?  
A) plasma membrane      B) Golgi bodies      C) cytosol      D) chloroplasts      E) nucleoid region
11. In the light-dependent reactions of photosynthesis, an excited electron from photosystem II is passed along an electron transport chain to \_\_\_\_\_.  
A) NAD<sup>+</sup>      B) NADH      C) oxygen      D) photosystem I      E) water
12. Water that moves through living cells in a root is following the \_\_\_\_\_.  
A) apoplastic pathway only      B) transmembrane pathway only  
C) symplastic pathway only      D) transmembrane and symplastic pathways  
E) apoplastic, transmembrane, and symplastic pathways

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13. Mycorrhizae, present for most plant species, generally do not help roots with the uptake of \_\_\_\_\_.  
A) nitrogen    B) carbon    C) phosphate    D) water    E) sugar
14. Consider a living plant cell in a living leaf that has a higher water potential than the fluids surrounding the cell. In such a situation there should be \_\_\_\_\_.  
A) a net flow of water out of the cell    B) a net flow of water into the cell  
C) no net flow of water into or out of the cell  
D) gain of water by the cell only if the cell's pressure potential is high enough  
E) gain of water by the cell only if the cell's pressure potential is low enough
15. The male gametophyte in flowering plants forms in a \_\_\_\_\_.  
A) corolla    B) receptacle    C) stamen    D) calyx    E) carpel
16. For a typical flowering plant, the first cell of the triploid (3n) endosperm is formed from \_\_\_\_\_.  
A) one sperm fused with two antipodal cells    B) two sperm fused with the egg  
C) one sperm fused with the synergid    D) two sperm fused with a synergid  
E) one sperm fused with the endosperm mother cell
17. The plant hormone \_\_\_\_\_ is primarily responsible for the bending of a plant shoot toward light.  
A) auxin    B) ethylene    C) systemin    D) salicylic acid    E) brassinosteroid
18. If you want to reduce the chance that plants you ship will suffer from shipping damage. You should apply \_\_\_\_\_ to the plants before shipping.  
A) cytokinins    B) abscisic acid    C) oligosaccharins    D) gibberellins    E) ethylene
19. In an animal in which the diploid number of chromosomes per cell is 24, what is the total number of chromatids present per cell in prophase II after the first division and cytokinesis?  
A) 6    B) 12    C) 24    D) 48    E) 96
20. A cross is performed between parents with genotypes  $xxYyZz$  and  $xxYyzz$ . What is the probability that the offspring will have the same genotype as the first parent? Capital letters indicate dominant alleles and lower case letters indicate recessive alleles.  
A) 1/8    B) 1/4    C) 3/8    D) 3/16    E) 9/16
21. During the elongation stage of transcription \_\_\_\_\_.  
A) DNA nucleotides are added to the transcript  
B) the transcript grows in the 5' to 3' direction  
C) transcription factors recruit RNA polymerase to the template strand  
D) the double helix remains single-stranded after being used as a template  
E) RNA polymerase binds to the promoter region
22. The poly(A) tail of an mRNA \_\_\_\_\_.  
A) is where the start codon is located    B) is where ribosomes attach at the start of translation  
C) covers the stop codon until it is needed    D) is where translation terminates  
E) protects the mRNA from attack by RNA-digesting enzymes
23. Insertion of two bases into the coding region of a gene just after the start codon of a gene will result in a \_\_\_\_\_ mutation.  
A) missense    B) chromosomal    C) frameshift    D) silent    E) nonsense
24. In eukaryotic cells, \_\_\_\_\_.  
A) gene expression is regulated mostly at the level of transcription  
B) all mRNAs tend to remain stable for about the same length of time  
C) mRNA activity is altered through modifications such as phosphorylation  
D) promoters are typically "on" in the absence of regulatory proteins  
E) genes involved in similar processes are clustered together in operons

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25. What do Wernicke's and Broca's regions of the brain affect?

- A) olfaction      B) vision      C) speech      D) memory      E) hearing

26. A caterpillar that never matures into an adult, but simply gets larger and larger with each molt. It might be possible that the caterpillar did not mature into an adult because of

- A) a lack of ecdysone.      B) a lack of juvenile hormone.      C) a lack of melatonin.  
D) a decreased level of ecdysone.      E) an increased level of juvenile hormone.

27. Which of the following is not a function of Sertoli cells?

- A) production of androgen-binding protein  
B) FSH stimulation of spermiogenesis  
C) protection of developing sperm from the male's immune system  
D) production of testosterone  
E) production of inhibin

## II. 解釋名詞 (每題 4 分，共 16 分)

1. RNA interference (RNAi)
2. ectotherm
3. species diversity
4. competitive exclusion

## III. 簡答題 (每題 6 分，共 30 分)

1. What is the **Bohr shift** about the affinity of hemoglobin for oxygen?
2. How has the bird lung adapted to the metabolic demands of flight?
3. Describe the relationships between **induction**, **determination**, and **differentiation**.
4. A patient who can produce antibodies against some bacterial pathogens, but not against viral infections. What kind of disorder probably he has in his immune system?
5. If you experimentally increase the concentration of  $\text{Na}^+$  outside a resting neuron while maintaining other ion concentrations as they were, what would happen to the cell's membrane potential? Explain your answer.

試題隨卷繳回