

國立中山大學 101 學年度碩士暨碩士專班招生考試試題

科目：普通生物學【海資系碩士班甲組選考】

題號：4149
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一、簡答題：（每題三分；25 題共 75 分）

- (1) What is the main source of energy for producers in an ecosystem?
- (2) The precise weight of a mole of some pure elements like silicon (Si) can vary slightly from the standard atomic mass, or even from sample to sample. Why?
- (3) You have two beakers. One contains a solution of HCl at pH = 1.0. The other contains a solution of NaOH at pH = 13. Into a third beaker, you slowly and cautiously pour 20 mL of the HCl and 20 mL of the NaOH. After complete stirring, the pH of the mixture will be?
- (4) Where are all components of thylakoids, DNA, and ribosomes found?
- (5) A number of systems for pumping ions across membranes are powered by ATP. Such ATP-powered pumps are often called ATPases although they don't often hydrolyze ATP unless they are simultaneously transporting ions. Because small increases in calcium ions in the cytosol can trigger a number of different intracellular reactions, cells keep the cytosolic calcium concentration quite low under normal conditions, using ATP-powered calcium pumps. For example, muscle cells transport calcium from the cytosol into the membranous system called the sarcoplasmic reticulum (SR). If a resting muscle cell's cytosol has a free calcium ion concentration of 10^{-7} M while the concentration in the SR is 10^{-2} M, then how is the ATPase acting?
- (6) What is Meiosis II similar to mitosis?
- (7) *Drosophila* (fruit flies) usually have long wings (+) but mutations in two different genes can result in bent wings (bt) or vestigial wings (vg). If a homozygous bent wing fly is mated with a homozygous vestigial wing fly, what kind of offspring would you expect?
- (8) The same gene that causes various coat patterns in wild and domesticated cats also causes the cross-eyed condition in these cats, the cross-eyed condition being slightly maladaptive. In a hypothetical environment, the coat pattern that is associated with crossed eyes is highly adaptive, with the result that both the coat pattern and the cross-eyed condition increase in a feline population over time. What conceptual statement is supported by these observations?
- (9) When male horses (stallions) and female donkeys (jennets) mate, they produce a sterile hybrid called a hinny. Hinnies occur much less frequently than do mules, but are just as healthy and robust as mules. Logically, what best accounts for the relative rarity of hinnies, and what kind of prezygotic isolating mechanism is at work here?
- (10) What is the term to describe an organism that obtains both carbon and energy by ingesting prey.

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- (11) You are designing an artificial drug-delivery "cell" that can penetrate animal cells. Which of the protist structures should provide the most likely avenue for research along these lines?
- (12) What are Acoelomates characterized by?
- (13) What are the excretory organs of annelids?
- (14) A new species of aquatic chordate is discovered that closely resembles an ancient form. It has the following characteristics: external armor of bony plates, no paired lateral fins, and a suspension-feeding mode of nutrition. In addition to these, what characteristics it will not probably have?
- (15) You have a freshly prepared 0.1 M solution of glucose in water. Each liter of this solution contains how many glucose molecules?
- (16) Plasmodesmata in plant cells are most similar in function to which structures in animal cells?
- (17) Two true-breeding stocks of pea plants are crossed. One parent has red, axial flowers and the other has white, terminal flowers; all F₁ individuals have red, axial flowers. The genes for flower color and location assort independently. If 1000 F₂ offspring resulted from the cross, approximately how many of them would you expect to have red, terminal flowers?
- (18) A man who is an achondroplastic dwarf with normal vision marries a color-blind woman of normal height. The man's father was 6 feet tall, and both the woman's parents were of average height. Achondroplastic dwarfism is autosomal dominant, and red-green color blindness is X-linked recessive. How many of their daughters might be expected to be color-blind dwarfs?
- (19) A proficient engineer can easily design skeletal structures that are more functional than those currently found in the forelimbs of such diverse mammals as horses, whales, and bats. The actual forelimbs of these mammals do not seem to be optimally arranged, why?
- (20) You are confronted with a box of preserved grasshoppers of various species that are new to science and have not been described. Your assignment is to separate them into species. There is no accompanying information as to where or when they were collected. Which species concept will you have to use?
- (21) The common ancestors of birds and mammals were very early (stem) reptiles, which almost certainly possessed three-chambered hearts (two atria, one ventricle). Birds and mammals, however, are alike in having four-chambered hearts (two atria, two ventricles). What is the best description for the four-chambered hearts of birds and mammals?

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- (22) When pathogenic fungi are found growing on the roots of grape vines, grape farmers sometimes respond by covering the ground around their vines with plastic sheeting and pumping a gaseous fungicide into the soil. What should be the most important concern of grape farmers who engage in this practice?
- (23) What distinguishes complete metamorphosis from incomplete metamorphosis in insects?
- (24) Why is the amniotic egg considered an important evolutionary breakthrough?
- (25) A water sample from a hot thermal vent contained a single-celled organism that had a cell wall but lacked a nucleus. What is its most likely classification?

二、翻譯題（英文翻譯成中文）（25 分）

The herpes viruses are very important enveloped DNA viruses that cause disease in all vertebrate species and in some invertebrates such as oysters. Some of the human ones are herpes simplex (HSV) I and II, causing facial and genital lesions, and the varicella-zoster (VSV), causing chicken pox and shingles. Each of these three actively infects nervous tissue. Primary infections are fairly mild, but the virus is not then cleared from the host; rather, viral genomes are maintained in cells in a latent phase. The virus can then reactivate, replicate again, and be infectious to others. In electron micrographs of HSV infection, it can be seen that the intact virus initially reacts with cell surface proteoglycans, then with specific receptors. This is later followed by viral capsids docking with nuclear pores. Afterward, the capsids go from being full to being "empty." The viral envelope mediates entry into the cell, the capsid entry into the nuclear membrane, and the genome is all that enters the nucleus.