

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【海生所碩士班】

題號：4143
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單選題 (choose the best answer among the 4 choices in each question, 100%).

1. Which of the following substances would have the most trouble crossing a biological membrane by diffusing through the lipid bilayer? (A) O₂ (B) CO₂ (C) Na⁺ (D) a small, nonpolar molecule such as butane (C₄H₁₀).
2. In biological systems, an important enzyme involved in the regulation of redox reactions is (A) glucose (B) dehydrogenase (C) oxygen (D) ATP.
3. Photoautotrophs (A) make sugar by using organic raw materials (B) produce organic molecules from inorganic molecules (C) eat other organisms that use light energy to make food molecules (D) include only the green plants.
4. What is the likely origin of chloroplasts? (A) mitochondria that had a mutation for photosynthesis (B) photosynthetic prokaryotes that lived inside eukaryotic cells (C) prokaryotes with photosynthetic mitochondria (D) eukaryotes that engulfed photosynthetic fungi.
5. Without crossing over (A) cells could not complete meiosis (B) meiosis could not produce haploid gametes (C) only a small number of unique gametes could be produced by a single individual (D) genetic recombination could not occur.
6. The basis of cellular differentiation is (A) the operon (B) selective gene expression (C) cloning (D) mutation.
7. Signal transduction pathways (A) are found strictly in multicellular organisms, which require cell-to-cell communication (B) are limited for use in sexual identification (C) originally evolved in vertebrates (D) are mechanisms of communication that probably evolved in ancient prokaryotes.
8. According to the fossil record, the genus *Homo* first arose in (A) North America (B) Europe (C) Asia (D) Africa.
9. Which of the following is a part of the immune system? (A) bone marrow (B) liver (C) pancreas (D) lungs.
10. Digestion is the (A) absorption of nutrients suspended in water (B) conversion of glycogen to glucose (C) breaking down of food into molecules small enough for the body to absorb (D) churning of food in the stomach and intestine.
11. What term refers to seasonal changes in the relative lengths of night and day? (A) photoperiod (B) circadian rhythm (C) gravitropism (D) phototaxis.
12. The level of ecologic organization that incorporates abiotic factors is the (A) community (B) ecosystem (C) population (D) species.
13. The type of recombinant bacteria most often used to mass-produce genes is (A) *Pseudomonas aeruginosa* (B) *Agrobacterium tumefaciens* (C) *Escherichia coli* (D) *Saccharomyces cerevisiae*.
14. The core theme of biology, which explains both the unity and diversity of life, is (A) genetics (B) ecology (C) evolution (D) metabolism.

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15. The role of a control in an experiment is to (A) provide a basis of comparison to the experimental group (B) prove that a hypothesis is correct (C) ensure repeatability (D) counteract the negative effect of the experiment.
16. Compared to a solution of pH 3, a solution of pH 1 is (A) 100 times more acidic (B) 10 times more acidic (C) 10 times more basic (D) 100 times more basic.
17. A scientist wants to magnify a pollen grain 8,000 times and examine the ridges and pores on its surface. Which one of the following instruments would be best? (A) a transmission electron microscope (B) a scanning electron microscope (C) a fluorescence confocal microscope (D) an inverted light microscope.
18. The emergence of many diverse species from a common ancestor is called (A) adaptive radiation (B) gradualism (C) allopatric speciation (D) hybridization.
19. Which of the following is a member of the domain Archaea? (A) gram-positive bacteria (B) methanogens (C) spirochetes (D) chlamydias
20. About 95% of all modern plant species (A) have a dominant sporophyte in their life cycle (B) have no gametophyte (C) have a gametophyte adapted to house a sporophyte stage (D) have flagellated sperm.
21. What kind of entity is a lichen? (A) an association between a fungus and a brown alga (B) an association between a multicellular protist related to the brown algae and a bacterium (C) an association between a fungus and cyanobacteria or green algae (D) an association between a bryophyte and a fungus.
22. Most of the animals alive today (A) are vertebrates (B) are invertebrates (C) are choanoflagellates (D) are really colonies of protist cells.
23. Which of the following adaptations allowed reptiles to complete their life cycles on land? (A) lungs (B) ectothermic metabolism (C) an amniotic egg (D) four legs.
24. Animals that effectively use their body surface for gas exchange must (A) be terrestrial (B) have a high ratio of body surface area to volume (C) have a low ratio of body surface area to volume (D) have a special kind of hemoglobin.
25. Medullary breathing centers directly sense and respond to (A) blood pH and CO₂ concentration (B) blood O₂ concentration (C) alveolar O₂ concentration (D) blood pH and O₂ concentration.
26. In humans, which blood vessels have valves? (A) arteries in the neck (B) arterioles (C) capillaries (D) veins.
27. What substance, produced by virus-infected cells, diffuses to neighboring cells to help them fight a viral infection? (A) lysozyme (B) interferon (C) histamine (D) interleukin-2.
28. The transfer of heat from arteries carrying warm blood past veins returning cooler blood is an example of (A) insulation (B) a countercurrent heat exchanger (C) evaporative cooling (D) behavioral thermoregulation.
29. All eukaryotic cellular movement is based upon contractile systems involving (A) cilia and flagella (B) pseudopodia and jet propulsion (C) microtubules and microfilaments (D)

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swimming and jet propulsion.

30. Skeletal muscles (A) are found in and around internal organs (B) get longer when they contract (C) work in antagonistic pairs (D) push on bones to make them move.
31. In the water relations of vascular plants, the cohesive property of water is most important in the (A) epidermis (B) xylem (C) internal air spaces (D) stomata.
32. The sending of, reception of, and response to signals constitute animal (A) cost-benefit analysis (B) communication (C) problem-solving (D) associative learning.
33. An *r*-selected species typically (A) offers considerable parental care to offspring (B) has an advantage in habitats that experience unpredictable disturbances (C) is large-bodied and long-lived (D) lives in stable climates.
34. An ecological footprint (A) is a means of determining increases in populations that lived in the past (B) is a means of understanding resource availability and usage (C) measures dispersion and adaptability (D) will estimate population movements.
35. Camouflage typically evolves as a result of (A) predation (B) interspecific competition (C) mutualism (D) herbivory.
36. The number of species in a community is called the (A) species diversity (B) species richness (C) species population (D) species index.
37. Greenhouse gases include (A) nitrous oxide and oxygen (B) nitrogen and oxygen (C) carbon dioxide and nitrogen (D) carbon dioxide and methane.
38. A single steroid hormone can cause different effects in different cells by (A) binding to different receptors (B) acting on different organelles (C) activating different second messengers (D) activating different enzymes.
39. Reproductive systems with external fertilization are most common in (A) terrestrial animals (B) populations with many more males than females (C) animals that are widely dispersed (D) aquatic animals.
40. Average global temperature has risen _____ over the past 100 years (A) 3°C (B) 10°C (C) 5°C (D) 0.8°C.

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Interpretation, 10 questions, 10 points each questions

翻譯（不需每字逐句翻譯；請將文內要點精準地以中文表達出來。第八題有畫底線的專有名詞可以直接引用而不譯）

1. About 3000 years ago, Central Africa was a landscape in transition. Flourishing evergreen forests were gradually giving way to grasslands as regional climate change pushed the formerly humid weather patterns toward drier, slightly warmer conditions.
2. Injecting a gene encoding glucose transporter from red blood cells gives microalgae the power to grow in the dark. Normally the microalgae rely on photosynthesis, but once reengineered, they can take up sugar for energy instead.
3. Climate change is causing destruction on coral reefs, heating and acidifying the waters in which they live. But some corals are actually benefiting from a warming world, according to a new study. In cooler regions, climate change has led to faster growth of a coral that's key to many reefs in the Indian Ocean.
4. Researchers in California have produced a cheap plastic capable of removing large amounts of carbon dioxide (CO₂) from the air. Down the road, the new material could enable the development of large-scale batteries and even form the basis of "artificial trees" that lower atmospheric concentrations of CO₂ in an effort to stave off catastrophic climate change.
5. Frigid temperatures can delay the potassium channels' closing, hindering the neuron's ability to transmit signal again. So researchers hypothesized that species inhabiting frigid climates have modified their potassium channels so they work better in the cold.
6. Most genetic mistakes land in unimportant places--the genome is a large document after all--but occasionally they occur in a region that, either individually or in combination with other factors, has been shown to cause a genetic disease. As our knowledge of the human genome expands, more and more of these genetic defects are discovered.
7. The Department of Biology at the University of Florida is seeking applications for a faculty position beginning August 2012 at the Assistant Professor level whose work is at the interface of animal physiology and either behavior or development. We are seeking candidates who will develop an internationally recognized, externally funded research program that builds on the strengths and interconnects the department's expertise in the fields of behavior, development, evolution, ecology, genetics, systematics, morphology, and physiology.

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8. Lipids constitute a broad group of naturally occurring molecules that include fats, waxes, sterols, fat-soluble vitamins (such as vitamins A, D, E, and K), monoglycerides, diglycerides, triglycerides, phospholipids, and others. The main biological functions of lipids include energy storage, as structural components of cell membranes, and as important signaling molecules.

9. Phytoplankton are photosynthesizing microscopic organisms that inhabit the upper sunlit layer of almost all oceans and bodies of fresh water. They are agents for "primary production," the creation of organic compounds from carbon dioxide dissolved in the water, a process that sustains the aquatic food web.

10. Bioenergy is renewable energy made available from materials derived from biological sources. Biomass is any organic material which has stored sunlight in the form of chemical energy. As a fuel it may include wood, wood waste, straw, manure, sugarcane, and many other byproducts from a variety of agricultural processes.