

國立中山大學八十八學年度碩博士班招生考試試題
科目：生物科學系碩士班 普通生物學 (甲、乙、丙組) 共 4 頁 第 1 頁

I. Multiple choice (each question has only one answer) (one point each) 50%

1. A _____ is the simplest animal to have _____.
(A) sponge bilateral symmetry (B) flatworm a body cavity (C) roundworm a complete digestive tract
(D) jellyfish a complete digestive tract (E) snail a body cavity
2. Which of the following animals does not have a body cavity?
(A) flatworm (B) ant (C) mouse (D) clam (E) earthworm
3. Which of the following phyla include numerous parasites and pests?
(A) roundworms and flatworms (B) mollusks and roundworms (C) annelids and flatworms
(D) annelids and roundworms (E) mollusks and flatworms
4. Phylum _____ includes the largest number of species.
(A) Mollusca (B) Arthropoda (C) Annelida (D) Chordata (E) Echinodermata
5. A _____ is a chordate but not a vertebrate. (A) lamprey (B) shark (C) lancelet (D) sea star (E) frog
6. After nutrients are absorbed, the blood carries them first to the
(A) brain (B) pancreas (C) kidneys (D) liver (E) large intestine
7. Which of the following has no specialized respiratory structures?
(A) crab (B) earthworm (C) salmon (D) ant (E) snake
8. Why are bird lungs more efficient than human?
(A) They use countercurrent exchange (B) They have more surface area than human lungs.
(C) They are able to concentrate the oxygen to much higher levels. (D) Their alveoli are much larger.
(E) They use a one-way rather than an in-out air flow system.
9. A disease called emphysema decreases the springiness of the lungs. This decreases _____ and makes it harder to breathe. (A) the volume of each breath. (B) respiratory rate (C) residual volume
(D) countercurrent exchange (E) vital capacity
10. The _____ is a structure specialized for diffusion of gases and nutrients between the blood of the mother and the fetus. (A) uterus (B) placenta (C) lamella (D) alveolus (E) umbilicus
11. Rhythmic stretching of the arteries caused by heart contractions is called
(A) hypertension (B) heart murmur (C) hemophilia (D) pulse (E) diastole
12. Heart valves function to
(A) keep blood moving forward through the heart. (B) mix blood thoroughly as it pass through the heart.
(C) control the amount of blood pumped by the heart. (D) slow blood down as it passes through the heart.
(E) propel blood as it passes through the heart.
13. Which of the following correctly traces the electrical impulses that trigger each heartbeat?
(A) ventricles - pacemaker - AV node - atria (B) pacemaker - AV node - atria - ventricles
(C) atria - pacemaker - AV node - ventricle (D) pacemaker - atria - AV node - ventricles
(E) pacemaker - AV node - atria - ventricles
14. The cells responsible for defense against infections are
(A) red blood cells (B) white blood cells (C) epithelial cells (D) platelets (E) pacemaker
15. An antigen is
(A) a protein molecule that help defend the body against disease. (B) a type of white blood cells.
(C) an invading virus or bacterium. (D) a foreign molecule that evokes an immune response.
(E) a body cell attacked by an invading microorganism
16. The AIDS virus infects mostly
(A) nervous system cells (B) B lymphocytes (C) cytotoxic T cells (D) suppressor T cells (E) helper T cells

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17. Blood flows through the hepatic portal vessel
(A) from the aorta to the kidney. (B) from the intestine to the liver. (C) from the kidney to the inferior vena cava (D) from the liver to the inferior vena cava (E) from the liver to the intestine
18. Steroid hormones are produced only by the
(A) adrenal medulla and pancreas (B) thyroid gland and pancreas (C) anterior and posterior pituitary
(D) thyroid gland and sex organs (E) sex organs and adrenal cortex
19. Which of the following is a form of sexual reproduction?
(A) budding (B) fission (C) fragmentation (D) regeneration (E) hermaphroditism
20. External fertilization occurs mostly in
(A) land animals (B) insects (C) aquatic animals (D) animals that reproduce asexually (E) mammals
21. The first stage of embryonic development is _____. This process produces
(A) gastrulation ... a three-layered embryo. (B) gestation ... a gastrula (C) ovulation ... a zygote
(D) cleavage ... a hollow ball of cells (E) parturition ... a fetus
22. The part of a neuron that carries nerve impulses toward the cell body is called
(A) a nerve (B) white matter (C) a neurotransmitter (D) a dendrite (E) an axon
23. Squids are useful animals in nervous system research because (A) their nervous system are so complex.
(B) they easily learn to respond to various stimuli. (C) their nerve fibers are so large. (D) they have a brain and spinal cord very similar to those of humans. (E) they are easy to breed and raise in the laboratory.
24. When you focus your eyes on a nearby object, the lenses (A) decrease in diameter
(B) move forward (C) become more rounded (D) become flatter (E) move backward.
25. As light passes into the eye, it goes through which of the following first?
(A) lens (B) pupil (C) aqueous humor (D) cornea (E) vitreous humor
26. Damage to the nerve from the saccule and utricle of the inner ear to the brain could result in
(A) loss of sense of taste (B) blindness (C) dizziness (D) loss of sense of smell (E) deafness
27. Which of the following is not one of the five kingdoms of living organisms?
(A) Protista (B) Viruses (C) Fungi (D) Monera (E) Animalia
28. A scientist wants to examine the way the cells lining the respiratory tract use tiny hairs to move dirt and mucus away from the lungs. Which of the following instruments would be best, and why?
(A) a light microscope, because it allows observations of whole, live cells
(B) a transmission electron microscope, because it has high resolving power
(C) a transmission electron microscope, because it is capable of very high magnification
(D) a scanning electron microscope, because it can reveal structures on cell surfaces
(E) a scanning electron microscope, because it can be used to observe whole cells without slicing them
29. Unlike animal cells, plant cells have _____ and _____. Unlike plant cells, animal cells have _____.
(A) large central vacuoles...cell walls...centrioles (B) centrioles...large central vacuoles...cell walls
(C) large central vacuoles...cell walls...cell membranes (D) chloroplasts...cell walls...cell membranes
(E) centrioles...cell walls...large central vacuoles
30. Plasmodesmata
(A) penetrate plant cell walls (B) are one type of cell junction (C) carry nutrients between plant cells
(D) carry chemical messages between plant cells (E) all of these
31. Rough endoplasmic reticulum
(A) contains microbodies (B) produces hydrogen peroxide (C) is covered with ribosomes
(D) is a site of lipid synthesis (E) is not connected to the membranes of the nuclear envelope

國立中山大學八十八學年度碩博士班招生考試試題
科目：生物科學系碩士班 普通生物學 (甲、乙、丙組) 共4頁 第3頁

32. Which of the following is not found in bacteria?
(A) a nucleus (B) pili (C) a cell wall (D) a capsule (E) ribosomes
33. A major function of glycoproteins and glycolipids in the cell membrane is to
(A) attach the cell membrane to the cytoskeleton (B) help the cell resist swelling
(C) allow the cells of an embryo to identify each other and sort into tissues
(D) glue cells together to form tissues (E) help the cell retain its shape
34. A cell that neither gains nor loses water when it is immersed in a solution is
(A) metabolically inactive (B) hypertonic to its environment (C) dead
(D) hypotonic to its environment (E) isotonic to its environment
35. The molecules responsible for membrane transport are
(A) ATP (B) phospholipids (C) proteins (D) carbohydrates (E) steroids
36. You have just discovered a new plant species that has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are not being absorbed by this pigment? (Remember that the colors of visible light include red, orange, yellow, green, blue, indigo, and violet.)
(A) red and yellow (B) blue, green, and red (C) blue and violet
(D) green, blue, and violet (E) green and yellow
37. In the major CO₂-fixing pathway found in all land plants, the acceptor molecule for CO₂ is:
(A) oxaloacetic acid (OAA). (B) ribulose biphosphate (RuBP). (C) phosphoenolpyruvate (PEP).
(D) phosphoglyceric acid (PGA). (E) glyceraldehyde phosphate (GaldP).
38. Which of the following gases was most likely not found in the earth's original atmosphere?
(A) Carbon monoxide (B) Nitrogen (C) Ammonia (D) Oxygen (E) Methane
39. Life emerged according to which sequence of events?
(A) accumulation of organic molecules--formation of polymers--interactions between polymers--cell-like compartmentalization--life (B) accumulation of organic molecule --formation of polymers--cell-like compartmentalization--interactions between polymers--life (C) formation of polymers--accumulation of organic molecules--interactions between polymers --cell-like compartmentalization--life (D) accumulation of organic molecules--cell-like compartmentalization--formation of polymers--interactions between polymers--life (E) none of the above
40. The first simple organic molecules to form in the oceans of the primitive earth were:
(A) Glucose, fatty acids, amino acids (B) Carbon dioxide, nitrogen, water (C) polynucleotides, polysaccharides, polypeptides (D) Prokaryotes, eukaryotes, glucose (E) none of these are thought to have been present
41. An important influence on Charles Darwin was Thomas Malthus, whose Essay on Population stated that:
(A) traits will flourish in a population if they are used more often (B) the food supply will always keep pace with a population (C) plants and animals reproduce at a geometric rate whereas food supply grows at an arithmetic rate (D) geologic isolation will control population size (E) acquired traits will be inherited
42. Regarding directional selection: (A) it selects for the extreme phenotype (B) it selects for two or more extreme phenotypes (C) it selects for the intermediate phenotype (D) an example of directional selection is sickle cell anemia (E) an example of directional selection is the adaptation of British land snails
43. What is the correct order of taxonomic classification from largest to small categories?
(A) domain, kingdom, phylum, family, genus, species (B) kingdom, domain, family, phylum, genus, species (C) domain, kingdom, phylum, genus, species, family (D) kingdom, domain, phylum, family, genus, species (E) phylum, domain, kingdom, genus, family, species

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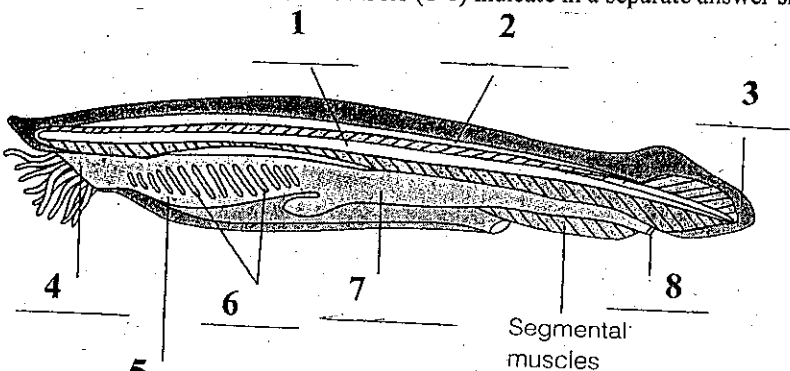
科目：生物科學系碩士班 普通生物學 (甲乙丙組) 共 4 頁 第 4 頁

44. The wing of a bird and the wing of an insect are a good example of which of the following:
 (A) vestigial structures (B) homologous structures (C) analogous structures
 (D) common ancestry (E) two of the above
45. The correct sequence of hominid species in the ancestral line to modern humans is:
 (A) Australopithecus boisei, A. africanus, Homo erectus, H. habilis, H. sapiens (B) A. africanus, A. robustus, H. erectus, H. habilis, H. sapiens (C) A. boisei, A. africanus, H. erectus, H. habilis, H. sapiens
 (D) A. afarensis, H. habilis, H. erectus, H. sapiens (archaic), H. sapiens (modern) (E) A. afarensis, A. robustus, H. erectus, H. habilis, H. sapiens (archaic), H. sapiens (modern)
46. Two hypotheses have been put forth to explain the origin of modern human beings: the "multiregional continuity" (MC) and the "out of Africa" (OA) models. The main difference between these two is:
 (A) MC states that H. erectus evolved into H. sapiens in Asia, Europe, and Africa completely isolated from one another (B) OA states that H. erectus evolved into H. sapiens in Asia, Europe, and Africa completely isolated from one another (C) OA states that H. erectus evolved into H. sapiens only in Africa, and later H. sapiens migrated into Europe and Asia (D) MC states that H. erectus evolved into H. sapiens only in Africa, and later H. sapiens migrated into Europe and Asia (E) A and C above are correct
47. By trapping insects, carnivorous plants obtain _____, which they need _____.
 (A) water .. because they live in dry soil (B) nitrogen .. to make sugar (C) phosphorus .. to make protein
 (D) sugars ... because they can make enough in photosynthesis (E) nitrogen .. to make protein
48. Mycorrhiza are
 (A) a mutually beneficial association of plant roots and fungi (B) a parasitic relationship of plant roots and fungi (C) a mutually beneficial association of plant roots and bacteria (D) structures used by carnivorous plants to trap insects (E) nodules that contain nitrogen-fixing bacteria
49. Which of the following produces sperm?
 (A) pollen grain (B) ovule (C) anther (D) ovary (E) sepal
50. Which of the following is closest to the center of a woody stem?
 (A) vascular cambium (B) young phloem (C) old phloem (D) young xylem (E) old xylem

II. Essay

1. Describe the structure and function of the autonomic nervous system. 8%
2. Make a list of several items for explaining the differences and similarities of the microscopic structure of the skeletal muscle and the cardiac muscle. 8%
3. Classify microscopes. 8%
4. Describe the life cycle of a typical fern. 8%
5. Describe the differences between the flowering plants and gymnosperms. 10%

III. Interpretation of structure of the body of amphioxus. Write down the specific terms that the arabic numbers (1-8) indicate in a separate answer sheet (1 point each term) 8%



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科目：生物化學(生科所甲、乙組) 共二頁 第 1 頁

Multiple choice: (15 %)

1. Which of the following amino acids would make the best buffer at pH 4.5?

- (A) alanine (B) histidine (C) glutamine (D) aspartic acid

2. The amino acid residues which have the highest frequency for occurrence in an α -helix are

- (A) asn, gly, thr (B) pro, cys, tyr
(C) ala, glu, met (D) gly, ser, ala

3. The following are all properties of cellulose except

- (A) It is stabilized by intramolecular hydrogen bonding.
(B) The linkages connecting the monomers are all $\alpha(1,4)$ O-glycosidic bonds.
(C) Cellulose is a linear, unbranched glucose polymer.
(D) Cellulose is a structural polymer found in plants but not in mammals.

4. The following are true statements about fatty acids linoleic and linolenic acid except

- (A) Both are essential fatty acids in humans.
(B) Both are polyunsaturated fatty acids.
(C) Both contain the same number of carbons as oleic acid.
(D) Both contain a *cis* double bond between carbons 15 and 16.

5. The component(s) of DNA which is responsible for the absorbance band at 250 - 270 nm is

- (A) bases, pentoses, and phosphates (B) only bases and pentoses
(C) only pentoses and phosphates (D) only bases

6. The hormone, glucagon, activates all of the following in liver cells except

- (A) adenylate cyclase (B) cAMP protein kinase
(C) biosynthesis of fatty acids (D) triacylglycerol lipase

7. The principal electron donor in fatty acid biosynthesis is

- (A) NADH (B) NADPH (C) NAD^+ (D) NADP^+

8. Amino acids which are considered glucogenic are degraded to any of the following except for

- (A) pyruvate (B) acetyl CoA (C) fumarate (D) α -ketoglutarate

國立中山大學八十八學年度碩博士班招生考試試題

科目：生物化學 (生科所甲、乙組) 共 2 頁 第 2 頁

9. Which of the following metabolic pathways is strictly anabolic?

- (A) TCA cycle (B) gluconeogenesis
(C) glycolysis (D) β -oxidation of fatty acids

10. Although macromolecular synthesis is driven by the hydrolysis of high energy acid anhydride bonds in NTPs, the only biosynthetic process below which is associated with the correct NTP is

- (A) ATP in protein synthesis (B) GTP in phospholipid synthesis
(C) CTP in DNA synthesis (D) UTP in polysaccharide synthesis

Problems: (85 %)

1. Traditionally, proteins have been purified on the basis of their size and electrical charge. Describe two protein purification techniques based on different size and charge respectively. (10 %)

2. Describe forces contribute to the overall conformation of globular proteins. (8 %)

3. Discuss the significance of chemical differences between DNA and RNA molecules. (6 %)

4. Discuss the metabolic role of ATP. (5 %)

5. Why are analogs of folic acid often employed as anticancer drugs? (6 %)

6. Describe how ATP is synthesized in chemiosmotic coupling during photosynthesis or respiration. (10 %)

7. Outline the principal regulatory mechanism in gluconeogenesis. (10 %)

8. Describe the steps of Northern and Southern blotting. (10 %)

9. Explain the following terms: (20 %)

- (A) photophosphorylation (B) entropy (C) allosteric regulation
(D) glycolysis (E) G protein

國立中山大學八十八學年度碩博士班招生考試試題

科目：分子生物學 (生科系甲、乙組選考)

共 2 頁 第 1 頁

I. Indicate which of the following statements are true (T) or false (F). (2% for each)

1. RNA polymerase activity of eukaryotic cells is found only in the nucleus.
2. Catenated DNA is formed during the replication of eukaryotic chromosomal DNA.
3. The major portion of higher eukaryote DNA does not encode proteins.
4. All eukaryotic genes are regulated by controlling initiation of transcription.
5. During RNA formation, the RNA chain is extended in the 3'→5' direction.
6. Ultraviolet radiation can cause pyrimidine bases to cross-link.
7. The replication of DNA requires the participation of dAMP, dTMP, dGMP, and dCMP.
8. The tRNA^{Met} has the anticodon TAC.
9. Most housekeeping genes encode low-abundance mRNAs.
10. The TATA box is present in all higher eukaryote promoters.
11. Bacteria may use an endonuclease to remove damaged bases.
12. The replication of DNA involves the formation of an RNA primer.
13. Heterogeneous nuclear RNA is the precursor of mRNA and rRNA, but not of tRNA.
14. Telomeres are essential for correct segregation of chromosomes at mitosis.
15. Glycosylase can remove a single damaged base from DNA.

II. Answer the following questions.

1. Please describe (with a cartoon/diagram) the operon model in detail, explaining also how the activation and repression of transcriptional regulation are achieved. (10 %)
2. As one cloned and sequenced a gene of interest, a downstream open reading frame was also observed simultaneously. What would be the most feasible ways to unravel or to understand the possible functions of the ORF? (10 %)
3. The human genome project is a scientific adventure. (15 %)
 - (A) What are the major works involved in the human genome project? (5 %)
 - (B) What are the potential benefits of having the complete map and nucleotide sequence of the human genome? (5 %)
 - (C) What are the ethical problems the society may encounter as the human genome project moves forward? (5 %)
4. Explain the followings. (15 %)
 - (A) restriction and modification system
 - (B) aminoacyl tRNA transferase
 - (C) ribosome binding site
 - (D) Okazaki fragment
 - (E) codon-anticodon interaction

國立中山大學八十八學年度碩博士班招生考試試題

科目：分子生物學

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5. Draw a detailed diagram illustrating the series of processing events that the initial transcript of a typical eukaryotic protein-coding gene must undergo before forming a functional protein. (10%)

6. (a) Define a DNA fingerprinting experiment. (3%)

(b) What is the probe used in DNA fingerprinting? (2%)

7. Point out a prominent incorrect statement from the following paragraph. (5%)

Ring farewell to the century of physics, the one in which we split the atom and turned silicon into computing power. It's time to ring in the century of biotechnology. Just as the discovery of the electron in 1897 was a seminal event for the 20th century, the seeds for the 21st century were spawned in 1953, when James Watson blurted out to Francis Crick how four nucleic acids could pair to form the self-copying code of a DNA molecule. Now we're just a few years away from one of the most important breakthroughs of all time; deciphering the human genome.

國立中山大學八十八學年度碩博士班招生考試試題
科目：動物生理學（生科系甲組選考）

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1. 試述哺乳動物之心動週期(cardiac cycles)，請在敘述文中包含下列項目：(10分)
 - 1) 血流動向
 - 2) 相關瓣膜之配合
 - 3) 心音之配合
 - 4) EKG 之配合
 - 5) ventricular pressure-volume curve (左心室血壓-血容量相關曲線)
2. 某人因參與實驗需呼吸含低氧之空氣(氧濃度約 16%)。試問數分鐘實驗之後此人之肺通氣量(pulmonary ventilation, L/min)、血液氣體量(blood gas)、及血液酸鹼平衡狀態(acid-base balance status)與實驗前有何不同？(10分)
3. 試以示意圖描繪骨骼肌、心肌、及神經受刺激後產生之動作電位圖，指出它們彼此間之差異、並說明此項差異之理由。(10分)
4. 列舉腦下腺(pituitary gland)分泌之 hormone，並述其個別之生理功能。(10分)
5. 試以模式圖說明腎小管上皮細胞之構造並說明：(10分)
 - 1) 鈉離子及水分子通過上皮細胞之原理
 - 2) 抗利尿素(antidiuretic hormone, ADH)及升血壓素(vassopressin)對上述機能之影響
6. 請列舉物質通過生物體細胞膜之方式。(8分)
7. 請敘述神經系統之分類。(8分)
8. 請說明動作電位之離子機制，並論證生物體可以產生動作電位之重要性。(15分)
9. 從生理學觀點，敘述肝臟細胞與神經細胞之異同。(10分)
10. 解釋名詞：
 - 1) motor unit (3分)
 - 2) neuromuscular junction (3分)
 - 3) reflex arc (3分)

國立中山大學八十八學年度碩博士班招生考試試題
科目：免疫學。(生科系甲組選考)

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I. True (O) and False (X): (10%)

1. Attenuated vaccines are more likely to induce cell-mediated immunity than killed vaccines are.
2. Most T_{DTH} cells belong to the T_{H1} subset.
3. Both production of syngeneic strains and congenic strains require sibling crosses.
4. Transfusion reactions are a manifestation of type II hypersensitivity.
5. The high-affinity IL-2 receptor consists of two transmembrane proteins.
6. The heavy chain variable region is twice as long as the light chain variable region.
7. The polymerase chain reaction is a sensitive test that can be used to detect antibodies to HIV.
8. A DNA vaccine only induces a response to a single epitope.
9. A thymic transplant can restore the immune defect in CB-17 SCID mice.
10. Both T_H and T_C cells recognize antigen that has been processed and presented with an MHC molecule.

II. Answer the following questions:

1. Describe the mechanisms that cause antibody diversity in the immunity. (10%)
2. What are the important factors for the development of a successful vaccine? (10%)
3. Draw the overview of the complement activation pathways with arrows (\rightarrow). (10%)
4. Explain following terms: (10%)
 - (1) Hyposensitization
 - (2) P-K reaction
 - (3) Pleiotropic cytokines
 - (4) Peptide-binding cleft
 - (5) Affinity maturation
5. Outline the cytokine secretion spectrum and principle functions of T_{H1} and T_{H2} subsets. (10%)
6. How are the different immunoglobulin isotypes functionally important in bacteriological diseases? In other word, how does the capacity of particular Ig classes and subclasses impact on host defense against bacterial infections? (10%)
7. Draw a diagram illustrating the general structure of MALT (mucosal associated lymphoid tissue). Briefly describe how the immune response is induced in MALT. (10%)
8. What is allelic exclusion and how does it confer monoclonality on B cells? What are the biological advantages of allelic exclusion? (5%)
9. HIV-1 patients have a low number of $CD4^+$ T cells. However, only a very small number of $CD4^+$ cells are infected with the virus. Studies have shown that soluble gp-120 from HIV-1 can render HIV-1 $CD4^+$ cells sensitive to HIV-1 specific cytotoxic T cells and account for this paradox. (a) What would be the predicted phenotype of the effector cells? (5%)
 - (b) What molecules would be the restricting elements for T cell recognition and why? (5%)
 - (c) Would you expect soluble gp-120 to render $CD4^-$ cells sensitive to anti-HIV specific CTL, why? (5%)

國立中山大學八十八學年度碩博士班招生考試試題

科目：微生物學（乙組 生物科學所選考）

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請務必依題目順序作答

1. Describe how each of the following bacterial processes are involved in the nitrogen cycle in nature. (10 pts)
 - A. Denitrification
 - B. Ammonification
 - C. Nitrification
 - D. Nitrogen fixation
2. Describe three ways in which the normal bacterial flora of the body benefits us. (6 pts)
3. Describe four mechanisms by which mutations that occur in bacteria can result in development in the bacteria of antibiotic resistance. (8 pts)
4. Penicillin is known to be most effective against Gram-positive bacteria that are actively multiplying. Why is this so? Archaeobacteria are resistant to the action of penicillin. Why is this so? (6 pts)
5. What molecular and biochemical evidence suggests that eukaryotic mitochondria and chloroplasts have evolved from procaryotic cells which either invaded, or were captured by, primitive nucleated cells? (10 pts)
6. Draw a typical growth curve for a bacterial population in a closed system (like a test tube). Label the coordinates on the graph. Label each of these phases of the growth cycle. Describe the physiological condition of the cells at each phase of the cycle. (8 pts)
7. Compare and contrast fermentation, aerobic respiration, and anaerobic respiration. (6 pts)
8. What is diauxic growth? Why is there a lag in growth after glucose is exhausted before growth on lactose commences? What is happening during the lag? (5 pts)
9. What are restriction enzymes? What is the prime function of a restriction enzyme in the cell which produces it? (5 pts)
10. Compare and contrast the properties of bacterial exotoxins and endotoxins. (6 pts)
11. Discuss the origin and the importance of the "envelope" that surrounds the nucleocapsid of many animal viruses. Why do you think that virtually all bacterial viruses lack an envelope? (5 pts)
12. Illustrate with diagrams and written designations a model for the lytic cycle and lysogenic cycle of phage lambda. (8 pts)
13. What are sulfa drugs and how are they similar to and different from antibiotics? What is the mechanism of action of the sulfa drugs (e.g. sulfanilamide)? (6 pts)
14. What is the etiological agent of tetanus? How is tetanus diagnosed, treated and prevented? (6 pts)
15. What is "bioremediation"? Give one example of the applications of bioremediation. (5 pts)

國立中山大學八十八學年度碩博士班招生考試試題
科目：植物生理學 (生科系乙組選考)

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1. Describe the composition and structure of plant membranes. What forces are responsible for the stability of the bilayer and how is the protein organized in the membrane? (10%)
2. Explain why transpiration rate tends to be greatest under conditions of low humidity, bright sunlight, and moderate wind. (10%)
3. What are the four compartments in a chloroplast and what principal functions are associated with each? (10%)
4. Describe the concept of a photosystem and how it is involved in converting light energy to chemical energy. (10%)
5. Describe the source-sink concept. To what extent are source-sink relationships involved in determining the direction and rate of translocation in the phloem? (10%)
6. Describe the mechanism of auxin action. 10%
7. cereal seeds. 10%
8. Describe the mechanism of gibberellin action in α -amylase production in cereal seeds. Describe the regulation of wall extensibility by phytochrome. 10%
9. Explain the following terms: (a). photomorphogenesis (b). acid growth (c). statolith (d). T-DNA (e). escape from photoreversibility 20%

國立中山大學八十八學年度碩博士班招生考試試題

科目：生態學 (生物科學系碩士班丙組)

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I
70% MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (每題=分)

- 1) A population is
 - A) the abiotic component of an ecosystem.
 - B) the highest level in the hierarchical organization of life.
 - C) a group of actually or potentially interbreeding organisms isolated in space and time.
 - D) all of the individuals of a particular species.
 - E) all of the organisms found within a given community.
- 2) The concept that maximum and minimum conditions affect the distribution of an organism is expressed as
 - A) Liebig's law of the minimum and maximum.
 - B) synecology.
 - C) a homeostatic mechanism.
 - D) the law of tolerance.
 - E) the reductionist law.
- 3) The sun's energy does not reach Earth uniformly because
 - A) the shape of Earth influences the amount of energy reaching the surface.
 - B) the elliptic orbit of Earth about the sun influences the concentration of solar energy.
 - C) the Earth tilts on its axis.
 - D) A, B, and C.
- 4) Daily torpor
 - A) is a result of adaptive thermogenesis.
 - B) is the afternoon nap taken by small mammals in order to conserve energy.
 - C) allows for supercooling of cell sap.
 - D) is the dropping of body temperature to near ambient temperature.
 - E) is the result of the lowered body temperature experienced by homeotherms at night.
- 5) The internal temperature of a plant is maintained by
 - A) its metabolism.
 - B) supercooling of its sap.
 - C) the position of its leaves and the reflectivity of its bark and leaves.
 - D) fat deposits in its cuticle.
- 6) One of the most important synchronizers for circadian rhythms is
 - A) altitude.
 - B) temperature.
 - C) rainfall.
 - D) soil type.
- 7) True calcifuges, such as rhododendrons,
 - A) can live in soils with a pH of less than 4.
 - B) cannot grow in soils rich in aluminum.
 - C) belong to a class of plants known as chloroses.
 - D) turn yellow in calcium-poor soil.
 - E) prefer soils rich in calcium.
- 8) When making an accurate estimate of crude density
 - A) you must take a direct sample of the entire population.
 - B) you also must know the abundance of a population.
 - C) you must know the age structure of the population.
 - D) you must know how individuals within the population are distributed.
- 9) Parents that produce many young
 - A) exhibit intensive parental care.
 - B) reproduce often.
 - C) invest little energy in parental care.
 - D) usually inhabit stable, well-established environments.

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科目：生態學

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- 10) In a life table L_x represents
- A) the number of time units left for all individuals to live for age x .
 - B) the fraction of the cohort that dies during age interval x .
 - C) the average years lived by all individuals in each age category.
 - D) the number of individuals that died over a particular period.
- 11) Which statement does not apply to scramble competition?
- A) This type of competition allows individuals to tap efficiently natural resources with little or no waste.
 - B) All individuals share resources equally.
 - C) This is more likely the type of competition seeds released by a plant must face.
 - D) The population density remains below what the environment can support.
- 12) If food was a limited resource, you would expect the size of an animal's territory to
- A) increase in size.
 - B) remain unchanged in size because territories are density independent.
 - C) All of the above.
 - D) decrease in size.
- 13) Commensalism is an interaction between two species in which
- A) neither benefit.
 - B) both are harmed.
 - C) one benefits and the other receives no benefit or harm.
 - D) both benefit.
- 14) Parasitism and _____ involve an interaction in which the fitness of one population is reduced and the fitness of the other is increased.
- A) competition
 - B) predation
 - C) commensalism
 - D) mutualism
- 15) The niche of a population is the
- A) total of all the interactions it has with other populations.
 - B) environment in which it lives.
 - C) the range in which it roams.
 - D) the sum of all its environmental requirements.
- 16) Allelopathy is a form of competition in
- A) mammals.
 - B) plants.
 - C) birds.
 - D) protozoa.
- 17) The sigmoidal shape of the Type III functional response curve may be due to
- A) intraspecific predation.
 - B) mimicry.
 - C) the predators search image.
 - D) niche shift.
 - E) intraguild predation.
- 18) Mullerian mimicry involves
- A) blending into the background.
 - B) intraguild predation.
 - C) tasty species mimicking distasteful species.
 - D) safety in numbers.
 - E) distasteful species mimicking each other.
- 19) In a Type I functional response:
- A) the number of prey taken increases as prey density increases.
 - B) the number of prey taken increases at a decreasing rate, to a maximum value.
 - C) handling time is a major component.
 - D) the number of prey taken is low at first, then increases until it approaches an upper limit.

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科目：生態學

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- 20) Nonsymbiotic mutualism may have evolved from:
A) predator-prey relationships.
B) commensalism.
C) parasite-host relationships.
D) exploitation of one population by another.
- 21) Which of the following is not applicable to population harvesting?
A) Though there are two levels of density from which a given sustained yield can be obtained, the maximum sustained yield can only be harvested at one density.
B) If some of the standing crop is removed each year, the population will decline, but will stabilize at a level at equilibrium with the rate of harvesting.
C) To obtain a croppable surplus, the population must be allowed to reach its maximum density.
D) All of the above are correct.
- 22) Charles Darwin probably would have agreed with which of the following statements?
A) Long-necked giraffes could find more food at the top of trees and survived to pass the trait on to their offspring.
B) Giraffes developed long necks by reaching to the tops of trees to eat leaves.
C) Giraffes have undergone several dramatic changes in the body structure since their creation.
D) Giraffes have had long necks since the time of their creation.
- 23) An outcome of speciation is:
A) convergent evolution. B) adaptive radiation.
C) parallel evolution. D) divergent evolution.
- 24) Species richness is
A) a measure of species similarity.
B) the number of autotrophs per unit area in a community.
C) the relative abundance of individuals of each species within a community.
D) highest in the least diverse communities.
E) the number of species in a community.
- 25) Which statement is correct?
A) Each successional community is a one-time product of a special set of abiotic and biotic factors.
B) You can predict the type of vegetation that will appear in a region, but you cannot predict the specific type of local vegetation.
C) The exact original composition of a community can never be duplicated after a disturbance has been made.
D) All the statements are correct.
- 26) The individualistic continuum concept of communities view(s)
A) species as integrated components of communities.
B) species coexistence as the result of similarities in their requirements and tolerances.
C) environmental gradients as forming clusters of like individuals.
D) a common evolutionary history to be the major determinant of species coexistence.
E) vegetation associations as the key to the understanding of community dynamics.
- 27) An example of an allogenic environmental effect is the:
A) eutrophication of lakes due to fertilizer run-off from farms.
B) heat dome effect of cities.
C) vertical profile of light in a forest.
D) lowering of ozone levels attributable to the release of CFCs.
E) decreasing atmospheric pressure with increasing altitude.

國立中山大學八十八學年度碩博士班招生考試試題

科目：生態學

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- 28) Most of the energy in an ecosystem is found in the:
A) omnivores. B) decomposers. C) autotrophs. D) herbivores.
- 29) Which of the following best describes a plant's short-term response to increased carbon dioxide?
A) increased photosynthesis and opening of stomata.
B) increased leaf area and decreased stomatal density.
C) increased photosynthesis and partial closure of stomata.
D) reduced rubisco production and increased photosynthesis.
E) reduced rubisco production and a reduction in the number of stomata on the leaf surface.
- 30) Which of the following is not a greenhouse gas?
A) O_2 B) O_3 C) SO_2 D) CH_4 E) HCFCs
- 31) Which of the following statements about animal life in grasslands is true?
A) Small grazing ungulates are the major vertebrates in grasslands.
B) Grazing animals recycle nutrients in grasses when they produce urine and dung.
C) The grasslands of Australia are inhabited by placental mammals.
D) There are few insect populations in grasslands.
- 32) Temperatures in deserts drop at night because:
A) high pressure air cells are located over deserts.
B) desert soils absorb much heat during the day.
C) deserts are found at high elevations.
D) the air is dry, and without cloud cover heat is not radiated back to the earth's surface.
- 33) The animals in deserts are:
A) generalists and opportunists.
B) highly specialized in their feeding behavior.
C) usually large carnivores.
D) few in numbers.
- 34) Deciduous forests have been highly modified by which of the following human activities?
A) Land clearing
B) Introduction of diseases and insects
C) Forest fires
D) Logging
E) All of the above
- 35) The soil in tropical rain forests is:
A) saline.
B) composed of several layers of rich humus.
C) very fertile.
D) infertile, with most of the nutrients concentrated in the upper 0.3 meter.

30% II ESSAY. Write your answer on a separate sheet of paper. (每題十五分)

- 36) Coral snakes are venomous. Their colorful markings look similar to the markings of a few non-venomous species. Under what conditions could these similarities be of value? How did they evolve?
- 37) What factors decide the size and complexity of food webs in different ecosystems?

國立中山大學八十八學年度碩博士班招生考試試題

科目：植物分類學 (丙組, 生科所選考)

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一. 給予下列植物檢索表以茲鑑定。(檢索表中每一行之特徵不超過四個) 20% (註: 即製檢索表以鑑定下列植物群)

Pteridophytes, Gymnosperms, Angiosperms, Monocotyledons, Cycas,
Dicotyledons, Zea, Pinus, Lilium, Magnolia, Nymphaea, Lycopodium
Selaginella

二. 列出一個形態特徵於下列各子題, 以區別各子題中之植物。30%
(註: 說明如何區別)

1. Selaginella vs. Psilotum

2. Taxus vs. Ginkgo

3. Cinnamomum vs. Ficus

4. Ranunculus vs. Hypericum

5. Polygonum vs. Chenopodium

6. Mimosa vs. Caesalpinia

7. Rosa vs. Oxalis

8. Hydrocotyle vs. Schefflera

9. Ipomoea vs. Cucurbita

10. Poa vs. Cyperus

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科目：

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三. 何謂 Character, Character state, Key character 和 good character?
(可舉例說明) 10%

四. 寫出具有下列各形態特徵的任一科科名(拉丁文科名, 廣義或狹義均可).
20% (最後一子題 2%)

1. Fruit a pome:

2. Inflorescence unit spiklets:

3. Ovary inferior, and stipulate:

4. Herbs with parallel veins
and pollens in pollinia:

5. Compound leaves and fruit
a legume:

6. Fruit a fig:

7. Inflorescence a catkin, and fruit
a nut which is at least partially
covered by a cupule:

五. 配合題 (在下列右方中選出最符合左方各問題之答案, 將代號填入左方括弧中) 20%

() 1. Epigynous flowers

() 2. Alternate leaves

() 3. Prostrate plants

() 4. Leaflets

() 5. Cauline

() 6. Compound leaves

() 7. Pubescent leaves

() 8. Serrate leaves

() 9. Dioecious plants

() 10. Ament

a. One kind of dry fruit

b. Leaves which are thick and fleshy

c. Flowers which are bisexual and arranged in
racemes

d. Flowers which have inferior ovary

e. One kind of fleshy fruit

f. Leaves which are smooth on both surfaces

g. A part of leaves

h. Root

i. One kind of leaf phyllotaxy

j. Leaves which are complicated in structure

k. Leaves which are hairy

l. Plants with unisexual flowers on different
individuals.

m. Flowers which have superior ovary

n. Leaves which are very thin

p. Leaves which have marginal teeth

r. Leaves which are emerged from water.

s. Plants with bisexual flowers

t. Plants growing flat on the ground

u. Leaves which have blades divided into
smaller bladelike parts

v. Plants with rhizomes

w. Leaves which are small

x. Stem

y. Catkin

z. Plants with polygamous flowers

國立中山大學八十八學年度(碩)博士班招生考試試題

科目：(生物科學系)脊椎動物學(內組選考)

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1. 以圖舉例比較 a. monophyletic b. paraphyletic c. polyphyletic group 15 分
2. 解釋 brood parasitism, 並舉例。10分
3. 列出五種不同科(family)目(order)台灣現生鳥類中文名，並寫出其所屬的科及目。15分
4. 討論並比較三種不同目兩生類生殖方式。15 分
5. 比較哺乳類、兩生類及爬行類的牙齒差別。10 分
6. 比較蛇與蜥蜴亞目的共同特徵及差異。10 分
7. 魚鰾的功用為何? 10分
8. 列舉下列動物特徵:
Insectivora 食蟲目, Chiroptera 翼手目, Pholidota 鱗甲目, Lagomorpha 兔形目及 Rodentia 嚙齒目. 並各舉台灣現生動物一種。15 分