I. Multiple Choice (each question has *only one* answer) (one point each)

1. Which of the following would *not* help an organism become larger by overcoming problems created due to surface area-to-volume relationships?
   (A) becoming unicellular (B) developing appendages
   (C) developing infoldings (D) developing internal gas-filled cavities
2. In describing the evolution of warm-bloodedness in mammals and birds, one would be mostly using
   (A) a macroevolutionary time scale. (B) a microevolutionary time scale.
   (C) a physiological time scale. (D) an ecological time scale.
3. Which of the following kingdoms consists of organisms that are mostly unicellular and have eukaryotic cells?
   (A) Fungi (B) Monera (C) Plantae (D) Protista
4. Which of the following kingdoms consists of organisms that are mostly multicellular, absorptive heterophs?
   (A) Animalia (B) Fungi (C) Plantae (D) Protista
5. Which of the following classes of lipids include important light-capturing molecules?
   (A) carotenoids (B) fats (C) steroids (D) triglycerides
6. What is the highest structural organization found in all enzymes?
   (A) primary (B) secondary (C) tertiary (D) quaternary
7. Which of the following structures are common to both prokaryotic and eukaryotic cells?
   (A) chromatin (B) nucleoplasm (C) ribosomes (D) none of the above
8. What would be the expected structural features of an intrinsic protein that spans the entire cell membrane?
   (A) entirely hydrophobic (B) entirely hydrophilic
   (C) hydrophobic ends, hydrophilic middle (D) hydrophilic ends, hydrophobic middle
9. Which of the following substances is most likely to permeate a membrane by diffusing directly through the lipid bilayer?
   (A) glucose (B) Cl^- (C) NH_3^+ (D) O_2
10. Which one of the following reactions is *least likely* to occur within the cells of a C_4 plant?
    (A) the Calvin-Benson cycle (B) CO_2 + PEP → oxaloacetate
    (C) photophosphorylation (D) photorespiration
11. If a cell has 44 chromosomes at the end of mitosis, how many will it have at the end of the next S phase?
    (A) 11 (B) 22 (C) 44 (D) 88
12. Red-green color blindness is an X-linked recessive trait in human. A color-blind woman and a man with normal vision have a son. What is the probability that the son is color blind?
    (A) 0% (B) 50% (C) 100% (D) variable
13. How many Barr bodies would you observe in the cells of an individual with Klinefeller syndrome and the genotype XXXXY?
    (A) 0 (B) 1 (C) 2 (D) 3

14. The enzyme needed to make cDNA from mRNA is
(A) a restriction endonuclease. (B) DNA ligase.
(C) DNA polymerase. (D) reverse transcriptase.

15. The earliest organisms were probably
(A) chemosynthetic. (B) obligate aerobes.
(C) obligate anaerobes. (D) photosynthetic.

16. If the frequency of allele b in a gene pool is 0.2, according to the Hardy-Weinberg rule the expected frequency of the genotype bbb in a triploid (3n) plant species would be
(A) 0.008 (B) 0.04 (C) 0.08 (D) 0.4

17. A bird species in which females help sister feed their nestlings is an example of
(A) artificial selection. (B) inclusive fitness.
(C) kin selection. (D) nonrandom mating.

18. Which of the following organisms would likely need the smallest area for speciation?
(A) a bird (B) a butterfly (C) a centipede (D) a rabbit.

19. Behavior is typically most useful for determining systematics in relationships at the level of
(A) kingdom. (B) phylum. (C) order. (D) genus.

20. Which of the following traits of a hypothetical plant would be expected to evolve most slowly?
(A) average leaf number (B) number of branching
(C) number of petals (D) type of leaf venation

21. Members of the mycoplasma are uniquely characterized by
(A) being among the largest of all known bacteria.
(B) being the only bacterial group without parasitic forms.
(C) entirely lacking cell walls.
(D) having more DNA than 80% of all other bacteria.

22. Red tides often produce deadly toxins that result in major fish kills. This phenomenon results from enormous population increased by species in which of the following algal group?
(A) diatoms (B) dinoflagellates (C) green algae (D) red algae

23. Which of the following cell types would never be found in a fungus?
(A) chitinous (B) diploid (C) flagellated (D) haploid

24. A moss would posses all but one of the following plant characteristics. Select the *exception*.
(A) cellulose in cell walls (B) spores
(C) sporophytic tissue (D) xylem and phloem

25. In all seedless vascular plants, meiosis takes place in
(A) archegonia. (B) microphylls. (C) rhizomes. (D) sporangia.

26. The increase in the diversity of simple grazing animals was followed by the rapid evolution of larger, more mobile predators. Which of the following is *not* a useful defense mechanism against predation?
(A) burrowing in mud or sand (B) improve locomotion
(C) increased rate of new species formation (D) protective shells

27. While dissecting a squid, you would expect to find all but one of the following. Select the *exception*.
(A) a beak
(B) a well-developed brain and visual system
(C) large grasping tentacles
(D) numerous interconnected plates forming a shell

28. Which of the following groups of chordates evolved prior to the appearance of cartilaginous fishes?
(A) agnathans and bony fishes (B) bony fishes and sea squirts
(C) tunicates and lancelets (D) none of the above

29. Which of the following vertebrate groups is arguably a living representative of the dinosaur lineage?
(A) amphibians (B) birds (C) mammals (D) lobe-finned fishes

30. Most of the human evolution has occurred during the
(A) Carboniferous period. (B) Devonian period.
(C) Paleozoic era. (D) Quaternary period.

31. Lenticels are functionally similar to which of the following structures?
(A) periderms (B) root hairs (C) stomata (D) vascular rays

32. Nitrogenase
(A) contains magnesium. (B) is sensitive to oxygen.
(C) releases two NH_3 molecules as products. (D) requires an anaerobic environment.

33. Pistils are formed from one or more
(A) anthers. (B) carpels. (C) ovaries. (D) ovules

34. If a species is a long-day plant it is likely to flower in
(A) early spring. (B) midsummer. (C) late summer. (D) fall.

35. A blood sample taken from a normal woman 30 minutes after eating a large meal would likely reveal elevated quantities of
(A) aldosterone. (B) cortisol. (C) glucagon. (D) insulin.

36. Which of the following contraceptive methods prevents embryo implanation?
(A) birth control pill (B) condom
(C) intrauterine device (D) vaginal jelly.

37. As water temperature increases
(A) CO_2 content of the water increases sharply. (B) barometric pressure decreases.
(C) O_2 content of the water decreases. (D) the diffusion rate of the O_2 decreases.

38. All but one of the following structures can be found in the transport system of a butterfly. Select the *exception*.
(A) artery (B) capillary (C) heart (D) transport fluid

39. A drug is given to an animal that completely blocks the absorption of nutrients from the digestive system. Which of the following is mostly severely impacted by this treatment?
(A) crop (B) esophagus (C) intestine (D) stomach

40. Which of the following is *not* presently a major cause of extinction?
(A) global warming (B) habitat destruction (C) overexploitation (D) overhunting

II. Match each of the following mechanosensors with the most apropriate description (one point each).

41. Organ of Corti	A. Pressure sensor in fishes
42. Pacinian corpuscle	B. Monitors forces muscles exert on bones
43. Golgi tendon organ	C. Senses balance in humans
44. Statocyst	D. Structure of the vertebrate cochlea
45. Vestibular apparatus	E. Skin vibration sensor
46. Lateral line	F. position sensor in a lobster

III. Match appropriate letters for characteristics listed on the right to the cytoskeletons listed on the left (two characteristics for one cytoskeleton) (two points each)

47. Microtubules	A. Actin
48. Microfilaments	B. Fibrous protein
49. Intermediate filaments	C. Tubulin
	D. Cytoplasmic streaming
	E. Nuclear lamin in nuclear envelope pore complex
	F. Preprophase band

Essay (12 points each)

IV. Describe the life cycle of a pine tree.

V. What do you think about bacteria and fungi produce plant hormones? (include your hypothesis on what advantage accrues to *Gibberella fujikoroi* in forcing seedling to grow so fast?)

VI. Recognizing foreignness, specificity, and memory are three main features of immune system. How does immune system manage to maintain these features?

VII. Explain how the hypothalamus control body functions through its action on the pituitary gland.

1. Describe three weak interactions (noncovalent interactions) in macromolecular proteins. (6%)

2. The amino acid is often used as the main buffer in biochemical experiments. The amino group of glycine, which has a pKa of 9.6, can either in the protonated form ($-NH_3^+$) or as the free base ($-NH_2$) because of the reversible equilibrium:

$$R\text{-}NH_3^+ \rightarrow R\text{-}NH_2 + H^+$$

(A) In what pH range can glycine be used as an effective buffer due to its amino group?
(B) In a 0.1 M solution of glycine at pH 8.6, what fraction of glycine has its amino group in the $-NH_3^+$ form? (10%)

3. Describe the principles of ion-exchange, size-exclusion (gel filtration), and affinity chromatography for protein purification. (9%)

4. Describe the mechanism of ATP formation in mitochondria and chloroplast. (10%)

5. Outline the C4 pathway for CO_2 fixation and point out the advantages in C4 plants. (10%)

6. Describe the mechanism of the action of steriod hormones. (5%)

7. Explain why each of the following statements is false in terms of efficient metabolic regulation: (10%)
(A) Most enzymes operate *in vivo* near V_{max}.
(B) End-product inhibition usually occurs at the last or next-to-last enzyme in a metabolic pathway.
(C) The enzymes regulated in a metabolic pathway usually exhibit simple Michaelis-Menten kinetics.
(D) Catabolic pathways tend to diverge from a single metabolite.

8. If in a certain anabolic pathway an enzyme step involves the phosphorylation of the substrate, the process is typically coupled with the conversion of an ATP to an ADP by the action of kinase. However, the catabolic version of the pathway often contains a hydrolysis reaction at this point. Why doesn't the organism just reverse the pattern involves in the anabolic pathway and form an ATP? (8%)

9. Membranes are known to repair themselves if punctured. Can you explain how this might occur? (6%)

10. Why have many inborn errors been found in the metabolism of amino acids in humans but none in glycolysis, the citric acid cycle, or electron transport? (8%)

11. Describe how glucose is oxidized to CO_2 in a fully active mammalian cell homogenate. (12%)

12. If a starving person (one who has gone a number of weeks with no food) is given a shot of insulin, what happens? Explain your answer. (6%)

國立中山大學八十七學年度碩博士班招生考試試題

科　目：動物生理學（甲組 生科所）

Physiol exam

解釋名詞: 共15分每題 3 分,請註明題號作答

1. Depolarization of neuron
2. Synaptic transmission
3. Ion channel
4. Receptor-mediated endocytosis
5. Organ of Corti

敘述題:請註明題號作答

1. 敘述骨骼肌收縮之機轉(mechanism of skeletal muscle contraction). 6%
2. 何爲心臟之傳導系統(conduction system of heart)? 冠狀動脈阻塞(occlusion of coronary artery)對於心臟有何影響? 6%
3. 維他命是維持身體健康之有機化學成份,敘述下列維他命: vitamin A, biotin, vitamin C,及 vitamin E 之作用(action),以及其缺乏造成之證狀(deficiency symptoms). 8%

4. 抗利尿激素(antidiuretic hormone, ADH)
   (1) 可於何處分泌?
   (2) 作用之部位(target organ)?
   (3) 影響ADH分泌之因素及其控制原理. (10%).

5. Extracellular recording 及 intracellular recording technique 都可用以記錄肌細 胞之膜電位變化
   (1) 比較二法所記錄之動作電位圖有何不同? 試繪示意圖並說明其產生差異之原理
   (2) 敘述一次動作電位形成之過程中細胞膜內外相關离子之流動情形.
   (3) 使細胞外液之鉀濃度由4mM升至8mM, 則此細胞受刺激而產生之動作電位有何不同? (15%)

6. 肺量之記錄可區分爲functional residual capacity, inspiratory reserve volume , tidal volume, vital capacity, expiratory capacity等, 試分別說明其代表之意義(解剖及生理上的都要討論) (15%)

7. 進食後血液流入消化系之流量大增, 何故? 試舉出控制血液流量之各項因子並說明其如何可用以解釋上項反應? (10%).

8. (1) 試在一縱座標軸爲心輸出血量而橫軸爲心室內壓力之座標上作出左心室在一次心動週期中之pressure-volume curve並加說明.
   (2) 動物大量失血後上圖有何變化?.
   (3) 試指出上圖各點對應之心音及ＥＫＧ相應圖 (15%)

I. Match for the BEST answer for the following cells. (10 %)

1. Memory B cell	A. μ heavy chain + surrogate light chain
2. Mature B cell	B. mIgM
3. Immature B cell	C. No Ig expressed
4. Pre B cell	D. mIgM + mIgD
5. Lymphoid cell.	E. mIg of various isotypes
6. M cell	F. Give rise to red blood cell
7. Monocyte	G. Macrophages found in the brain
8. Bone-marrow stromal cell.	H. Secrete CSFs
9. Myeloid stem cell	I. Specialized epithelial cells found in MALT patients
10. Microglial cell	J. 1-6 % in normal human adult WBC count

II. Treu (O) and False (X): (20%)

11. Vκ gene segments sometimes join to Cλ gene segments.
12. All Ig molecules on the surface of a given B cell have the same isotype.
13. Each B cell carries two alleles encoding the Ig heavy and light chains but only one is expressed.
14. Class II MHC molecules typically bind to slightly longer peptides than do calss I molecules.
15. Removal of introns, capping, and addition of a poly-A tail, process primary transcripts into functional mRNA.
16. All Ig molecules derived from a single myeloma clone have the same allotype.
17. A rabbit immunized with rat IgG2a will produce antibody that reacts with all subclasses of IgG in rats.
18. In outbred populations, an individual is more likely to be histocompatible with one of its parents than with its siblings.
19. A hapten can stimulate Ab formation but cannot combine with Ab molecules.
20. T-cell epitopes tend to be accessible amino acid residues that can interact with the T-cell receptor.
21. Both humoral and cell-mediated immunities involve processed antigen.
22. B-cell epitopes are often nonsequential amino acids brought together by the tertiary conformation of a protein antigen.
23. Each MHC molecule binds a unique peptide.
24. Carriers are needed only if one wants to elicit a cell-mediated response.
25. A monoclonal antibody specific for β2-microglobulin can be used to detect both class I MHC K and D molecules on the surface of the cells.
26. Both production of syngeneic strains and that of congenic strains require sibling crosses.

27. IL-4 decreases IgE production by plasma cells.
28. The indirect hemolytic plaque assay detects only IgG-secreting plasma cells.
29. Translocation of c-*myc* gene is found in many patients with Burkitt's lymphoma.
30. Patients with advanced stages of AIDS always have detectable antibody to HIV.

III. Indicate which type(s) of hypersensitive reaction (I-IV) apply to the following characteristics. Each characteristic can apply to <u>one or more than one</u> type. (10 %)

31. Can lead to symptoms of asthma
32. Can be induced by penicillin
33. Involves histamine as an important mediator
34. Can be induced by poison oak in sensitive individuals
35. an important defense against intracellular pathogens
36. Occur as result of mismatched blood transfusion
37. One form of clinical manifestation is prevented by Rhogam
38. Localized form characterized by wheal and flare reaction
39. Systemic form of reaction is treated with epinephrine
40. May involve cell destruction via ADCC

IV. Select the MOST appropriate characteristic. (5 %)

41. Goodpasture's syndrome	A. Autoantibodies to DNA
42. Autoimmune hemolytic anemia	B. Autoantibodies to IgG
43. Systemic lupus erythematosus	C. Autoantibodies to RBC antigens
44. Rheumatoid arthritis	D. Autoantibodies to acetylcholine receptor
45. Myasthenia gravis	E. Autoantibodies to basic membrane

V. Answer the following questions: (55 %)

(1) Discuss the unique mechanisms each of the following pathogens has for escaping the immune response: (a) African trypanosomes, (b) *Plasmodium* species, and (c) influenza virus. (15%)
(2) Draw the basic structure of the αβT-cell receptor and compare it with the basic structure of membrane-bound immunoglobulin. (10%)
(3) The myeloma cells used in the production of B-cell hybridomas have three properties that make them suitable fusion partners. List these properties and explain why they are necessary for the production of hybridomas that secrete B-cell antibodies. (10%)
(4) What mechanisms generate the three hypervariable regions (complementarity-determining regions, CDR) of immunoglobulin heavy and light chais? Why is the third hypervariable region (CDR3) more variable than the other two (CDR1 and CDR2)? (10%)
(5) Briefly outline the ELISA test for HIV infection indicating which antigen and antibody are used. (10%)

I. Multiple Choice : (3% each for Questions 1-10, 2% each for Questions 11-20, total 50%)

1. Which of the following enzymes is/are involved in excision repair in *E. coli* ? [A] helicase II [B] ligase [C] reverse transcriptase [D] DNA polymerase I [E] UvrABC

2. The most proper temperature to keep a phage library (in SM buffer containing 100 mM NaCl, 10 mM $MgSO_4$, pH 7.5) is [A] -80°C [B] -20°C [C] 4°C [D] 25°C [E] 37°C

3. Which of the following statements about Northern Blotting is/are not true ? [A] RNA is denatured and unfolded by formaldehyde [B] to detect specific RNA [C] use DNA probe for detection [D] separate DNA by gel electrophoresis [E] blotting to nitrocellulose filter

4. Which of the following statements about operator/repressor is/are true ? [A] operators usually are palindroms [B] operators may overlap with promoter sequence [C] repressors are usually dimeric molecules [D] repressors ususlly have helix-turn-helix motif [E] repressors usually have a regulatory factor binding site

5. Which of the following methods is/are used for studying DNA-protein interaction ? [A] DNaseI footprinting experiment [B] electrophoretic mobility shift assay [C] restriction enzyme site protection assay [D] pulse-chase experiment [E] Southern hybridization

6. One transform *E. coli* with 1 microgram pUC18 plasmid (2.8 kb) and obtained approximately 10^6 transformants. What is the transfomation efficiency (number of plasmid molecules entered and replicated in *E. coli* / per plasmid molecule) ? [A] 3×10^{-2} [B] 3×10^{-3} [C] 3×10^{-4} [D] 3×10^{-5} [E] 3×10^{-6}

7. After you cloned and sequenced a DNA fragment (possibly a gene), What would be the best next step that may bring you some insights about its possible biological function ? [A] analyze the sequence and see if it contains an open reading frame [B] do sequence comparison through network [C] complete a restriction enzyme mapping [D] overexpress it and purify the protein [E] obtain the protein and determine the amino acid sequence

8. Restriction enzyme action needs proper conditions containing/having [A] optimal temperature [B] suitable buffer and pH [C] metal ions, such as Mg^{2+} [D] polyethylene glycol [E] reducing agents, such as β-mercaptoethanol

9. Which of the following statements is/are not true about the nature and function of telomerase and telomere ? [A] telomeres consist of repetitive oligomeric sequence [B] telomerase prevents progressive shortening of the lagging strands during prokaryotic DNA replication [C] telomerase is a modified reverse transcriptase [D] telomerase is a ribonucleoprotein complex [E] none of the above

10. Cloning vectors commonly used in *E. coli* may contain the following segments, such as [A] antibiotic resistance gene [B] ori C [C] polyadenylation site [D] multiple cloning site [E] strong promoters, such as SV40 promoter

11. Transport of mRNA from the nucleus to the cytoplasm
    A. occurs at the S phase
    B. is in the 3' to 5' direction
    C. occurs with protein bound to mRNA
    D. is linked to translation of the protein encoded by the mRNA
    E. occurs with the spliceosome bound to mRNA

12. According to the molecular definition of a gene, which of the following elements can not be part of a eukaryotic gene?
    A. poly-A signal
    B. poly-A tail
    C. sequences not translated into protein
    D. promoter
    E. enhancer

13. Which one of the following statements concerning alternative splicing is not correct?
    A. It can yield different products from the same pre-mRNA in males and females.
    B. It can result in cell type-specific protein expression.
    C. It can skip over a stop codon in a mRNA.
    D. It occurs in the pre-mRNAs produced from simple transcription units.
    E. It yields protein that share some amino acid sequences but also have different sequences.

14. The replisome of both prokaryotes and eukaryotes contains several proteins that function at replication forks. Which one of the followings is not accessory to replisome?
    A. topoisomerase
    B. polymerase
    C. helicase
    D. sliding clamp protein
    E. single-strand DNA binding protein

15. Which one of the followings is not families of DNA-binding domains?
    A. Helix-turn-helix
    B. zinc fingers
    C. Leucine zipper
    D. Leucine fingers
    E. Helix-loop-helix

16. Which one of the following statements is not correct?
    A. Yeast have chromosome.
    B. Yeast contain circular chromosome.
    C. Yeast have organelles.
    D. Yeast have less DNA than other eukaryotes.
    E. Yeast have plasma membrane.

17. Denaturation of DNA is facilitated by
    A. low temp.erature
    B. high salt.
    C. low salt.
    D. the presence of an unrelated DNA.
    E. addition of organic solvent.

18. DNA-repair systems
    A. are found only in eukaryotic cells.
    B. may cause inactivation of oncogenes.
    C. include only nucleotide exicision repair and base excision repair.
    D. that are defective are associated with increased probability of developing certain cancers.
    E. sometimes coupled with translation.

19. The haploid amount of DNA in the cells of most eukaryotes
    A. is about 10^4 base pair.
    B. is about 10^5 base pair.
    C. is about 10^6 base pair.
    D. is greatest among some members of the Reptile.
    E. ranges from 5×10^8 to 10^{10} base pairs.

20. Which one of the following macromolecules has a sense of direction?
    A. glycogen
    B. starch
    C. glycerol
    D. cellulose
    E. cellulase

II. Answer the following questions. (Total 50%)

1. What is the secondary genetic code ? Please describe with a cartoon. (7%)

2. The 16S RNA sequences are commonly used as evolutionary markers, especially for microorganisms. Please explain why and how to do the experiment (explain with a flow chart). (7%)

3. DNA sequencing and sequence analysis are basic methods for molecular biologists. Please draw a diagram and explain the principle of Sanger's dideoxy chain-termination method. (6%)

4. Define the following terms: 3% each, total 15%
   a. RNA editing
   b. Ubiquitin
   c. Topoisomerase
   d. Molecular chaperone
   e. Antisense nucleic acids

5. What is intron? Discuss whether intron is functional or nonfunctional. (5%)

6. Discuss the roles telomerase played in the cell and its correlation to tumorigenesis. (10%)

請務必依題目順序作答

1. How is an F+ strain of *E. coli* different from an Hfr strain? (5 pts)

2. What is meant by "+" RNA? (5 pts)

3. One of the smallest bacterial genomes is found in *Mycoplasma hominis*, just over one million base pairs of DNA. Assume that an average protein contains 300 amino acids. Roughly how many such proteins could be encoded by this DNA? (5 pts)

4. What is "diauxic growth"? Give an example. (5 pts)

5. Contrast fermentation and respiration as strategies for obtaining energy. Give specific examples of each, and discuss their relative efficiency , their environmental impact, and positive and negative benefits to humans. (6 pts)

6. What is the molecular basis for the establishment of three cellular Kingdoms: Archaea, Eubacteria, Eukarya? Distinguish the three cell domains on the following basis:
(1) ribosome size; (2) cell membrane lipids; (3) cell wall composition;
(4) cytoplasmic organelles. (8 pts)

7. Every microorganism seems to have evolved every possible competitive edge to beat out other organisms in a constant struggle for success in growth and replication. Then, why in nature is there not one dominant organism? Have we all reached an equilibrium where all organisms coexist, or is this an illusion? (7 pts)

8. What is a "protoplast"? Can you make protoplasts from *Escherichia coli*? If yes, list the procedures in detail. If not, give the reasons for why not. (7 pts)

9. Contrast prokaryotic ribosome and eukaryotic ribosome. (6 pts)

10. You dilute an unknown soil sample to 10^{-5}. A 0.1 ml sample from that concentration produced 230 colonies on a plate. Someone asks you "How many bacteria are in 1 gram of this soil?" What should you answer? (7 pts)

11. Drug resistance is becoming a serious problem. Describe different ways in which bacteria can become resistant to an antibiotic. (6 pts)

12. How would you characterize an organism which could: (5 pts)
(1) use CO_2 as its sole C-source?
(2) use N_2 as its sole N-source?
(3) use light as its sole Energy source?
(4) use H_2S as its sole Energy source?
(5) use glucose as its C- and Energy source?

13. Can you use a deletion strain for the Ames test? Why? (5 pts)

14. List the detail procedures of doing a Gram staining. (10 pts)

15. Discuss the origin and the importance of the "envelop" that surrounds the nucleocapsid of many animal viruses. Why virtually all bacterial viruses lack an envelop? (8 pts)

16. What are "Koch's postulates"? (5 pts)

(橫書式) 國立中山大學八十七學年度碩博士班招生考試試題

科 目：植物生理學 (乙組 生科所選考) 共 1 頁 第 頁

1. Describe the pathway of water crosses the root radially via the apoplast, transmembrane, and symplast pathways until it reaches the endodermis. 10%

2. Describe the physiological mechanisms during stomatal opening and closing. 10%

3. Describe the mechanisms of phloem loading and phloem unloading in plants. 10%

4. Describe the pathway of CO_2 fixation in C_4 species. 10%

5. Describe the biological role of cytokinins. 10%

6. Describe the relationship between calcium and one particular plant physiological response. 10%

7. Describe the factors causing the flowering in higher plants. 10%

8. Describe how phytochrome regulate the synthesis of Rubisco protein. 10%

9. Describe the mechanism of plant hormones action (give one example) 10%

10. Describe how plants produce resistance to plant pathogen invasion. (10%)

(橫書式) 國立中山大學八十七學年度(碩)博士班招生考試試題

科 目：生態學 (生科所丙組)

I. 解釋名詞 (5 points each)

1. connectance

2. law of the minimum

3. competition

4. species diversity

II. 申論題 (20 points each)

1. 試說明族群的增長模式，並試舉例說明之。

2. 試述形成群聚(Community)構造的理論。影響群聚構造變動的因素為何？

3. 依不同的生態系統，試說明與分析生態系統中的能量流動？

4. 試說明氮在生態系統中的流動。

國立中山大學八十七學年度(碩)博士班招生考試試題

科　目：生物統計學(生物科學所 丙組選考) 共 4 頁 第 1 頁

1. For the following data, compute the mean, median, mode, standard deviation and coefficient of variation. 5 分

2　2　3　3　3　5

2. The probability that a person suffering from headache will be cured with a particular drug is 0.8. Three randomly selected patients are given the drug. Find the probability that the number cured will be:

a. exactly zero.

b. two or fewer.

c. more than one. 12 分

3. Heights (cm) were measured on a sample of 5 plants：

90　80　70　70　60

Compute the 95 percent confidence interval for the mean of the population. 8 分

4. The following data are the weight losses of mice before and after taken a drug. Is there evidence that a difference exists? Let $\alpha=0.01$. (State the null hypothesis.) 15 分

before	after
110	90
85	75
80	70
80	90
60	60

5. The following data are obtained on the latitude of the natural breeding range, and the length of the breeding season in days of 11 species of diving ducks:

latitude	length of breeding seasons
30	110
40	100
45	80
47	70
50	60
50	50
53	40
54	35
55	33
60	25
65	20

a. Plot a scattergram for these data. Based on the scattergram, do you consider that linear regression is applicable?

b. Find the linear regression equation using the latitude of the natural breeding range to predict length of breeding seasons. 20 分

6. The weights of mice fed on three different diets were measured as follows:

Diets		
A	B	C
90	70	80
100	80	60
100	70	40

a. Determine the ANOVA table for the data.
b. State the null hypothesis and test whether there are any significant weight differences among the mice fed on the three diets. 20 分

5. Three hundred randomly selected, blooming plants are investigated for the association between flower color, and the presence or absence of fragrance.

	Flower color			
Fragrance	Blue	Red	Orange	Total
Yes	20	100	60	200
No	60	10	60	130
Total	80	110	120	300

a. State the appropriate null hypothesis.
b. Can H_0 be rejected? What conclusion can be drawn from these data? 20 分

（橫書式）

國立中山大學八十七學年度碩博士班招生考試試題

科　目：生物統計學（生物科學所）內組選考　　共 4 頁　第 3 頁

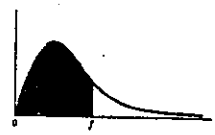
TABLE E Percentiles of the *t* Distribution

d.f.	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$
1	3.078	6.3138	12.706	31.821	63.657
2	1.886	2.9200	4.3027	6.965	9.9248
3	1.638	2.3534	3.1825	4.541	5.8409
4	1.533	2.1318	2.7764	3.747	4.6041
5	1.476	2.0150	2.5706	3.565	4.0321
6	1.440	1.9432	2.4469	3.143	3.7074
7	1.415	1.8946	2.3646	2.998	3.4995
8	1.397	1.8595	2.3060	2.896	3.3554
9	1.383	1.8331	2.2622	2.821	3.2498
10	1.372	1.8125	2.2281	2.764	3.1693
11	1.363	1.7959	2.2010	2.718	3.1058
12	1.356	1.7823	2.1788	2.681	3.0545
13	1.350	1.7709	2.1604	2.650	3.0123
14	1.345	1.7613	2.1448	2.624	2.9768
15	1.341	1.7530	2.1315	2.602	2.9467
16	1.337	1.7459	2.1199	2.583	2.9208
17	1.333	1.7396	2.1098	2.567	2.8982
18	1.330	1.7341	2.1009	2.552	2.8784
19	1.328	1.7291	2.0930	2.539	2.8609
20	1.325	1.7247	2.0860	2.528	2.8453
21	1.323	1.7207	2.0796	2.518	2.8314
22	1.321	1.7171	2.0739	2.508	2.8188
23	1.319	1.7139	2.0687	2.500	2.8073
24	1.318	1.7109	2.0639	2.492	2.7969
25	1.316	1.7081	2.0595	2.485	2.7874
26	1.315	1.7056	2.0555	2.479	2.7787
27	1.314	1.7033	2.0518	2.473	2.7707
28	1.313	1.7011	2.0484	2.467	2.7633
29	1.311	1.6991	2.0452	2.462	2.7564
30	1.310	1.6973	2.0423	2.457	2.7500
35	1.3062	1.6896	2.0301	2.438	2.7239
40	1.3031	1.6839	2.0211	2.423	2.7045
45	1.3007	1.6794	2.0141	2.412	2.6896
50	1.2987	1.6759	2.0086	2.403	2.6778
60	1.2959	1.6707	2.0003	2.390	2.6603
70	1.2938	1.6669	1.9945	2.381	2.6480
80	1.2922	1.6641	1.9901	2.374	2.6388
90	1.2910	1.6620	1.9867	2.368	2.6316
100	1.2901	1.6602	1.9840	2.364	2.6260
120	1.2887	1.6577	1.9799	2.358	2.6175
140	1.2876	1.6558	1.9771	2.353	2.6114
160	1.2869	1.6545	1.9749	2.350	2.6070
180	1.2863	1.6534	1.9733	2.347	2.6035
200	1.2858	1.6525	1.9719	2.345	2.6006
∞	1.282	1.645	1.96	2.326	2.576

TABLE A.4
Probability of a random value of $Z = (Y - \mu)/\sigma$ being greater than the values tabulated in the margins

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641
0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
3.6	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.9	.0000									

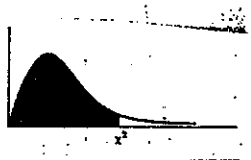
Cumulative *F* distribution



$$P[F_{\gamma_1,\gamma_2} \le f] = .95$$

γ_2 \ γ_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.

Cumulative chi-squared distribution



$$F(\chi^2) = P[X^2 \le \chi^2]$$

γ \ F	.005	.010	.025	.050	.100	.250	.500	.750	.900	.950	.975	.990	.995
1	.0000393	.000157	.000982	.00393	.0158	.102	.455	1.32	2.71	3.84	5.02	6.63	7.88
2	.0100	.0201	.0506	.103	.211	.575	1.39	2.77	4.61	5.99	7.38	9.21	10.6
3	.0717	.115	.216	.352	.584	1.21	2.37	4.11	6.25	7.81	9.35	11.3	12.8
4	.207	.297	.484	.711	1.06	1.92	3.36	5.39	7.78	9.49	11.1	13.3	14.9
5	.412	.554	.831	1.15	1.61	2.67	4.35	6.63	9.24	11.1	12.8	15.1	16.7
6	.676	.872	1.24	1.64	2.20	3.45	5.35	7.84	10.6	12.6	14.4	16.8	18.5
7	.989	1.24	1.69	2.17	2.83	4.25	6.35	9.04	12.0	14.1	16.0	18.5	20.3
8	1.34	1.65	2.18	2.73	3.49	5.07	7.34	10.2	13.4	15.5	17.5	20.1	22.0
9	1.73	2.09	2.70	3.33	4.17	5.90	8.34	11.4	14.7	16.9	19.0	21.7	23.6
10	2.16	2.56	3.25	3.94	4.87	6.74	9.34	12.5	16.0	18.3	20.5	23.2	25.2
11	2.60	3.05	3.82	4.57	5.58	7.58	10.3	13.7	17.3	19.7	21.9	24.7	26.8
12	3.07	3.57	4.40	5.23	6.30	8.44	11.3	14.8	18.5	21.0	23.3	26.2	28.3
13	3.57	4.11	5.01	5.89	7.04	9.30	12.3	16.0	19.8	22.4	24.7	27.7	29.8
14	4.07	4.66	5.63	6.57	7.79	10.2	13.3	17.1	21.1	23.7	26.1	29.1	31.3
15	4.60	5.23	6.26	7.26	8.55	11.0	14.3	18.2	22.3	25.0	27.5	30.6	32.8
16	5.14	5.81	6.91	7.96	9.31	11.9	15.3	19.4	23.5	26.3	28.8	32.0	34.3
17	5.70	6.41	7.56	8.67	10.1	12.8	16.3	20.5	24.8	27.6	30.2	33.4	35.7
18	6.26	7.01	8.23	9.39	10.9	13.7	17.3	21.6	26.0	28.9	31.5	34.8	37.2
19	6.84	7.63	8.91	10.1	11.7	14.6	18.3	22.7	27.2	30.1	32.9	36.2	38.6
20	7.43	8.26	9.59	10.9	12.4	15.5	19.3	23.8	28.4	31.4	34.2	37.6	40.0
21	8.03	8.90	10.3	11.6	13.2	16.3	20.3	24.9	29.6	32.7	35.5	38.9	41.4
22	8.64	9.54	11.0	12.3	14.0	17.2	21.3	26.0	30.8	33.9	36.8	40.3	42.8
23	9.26	10.2	11.7	13.1	14.8	18.1	22.3	27.1	32.0	35.2	38.1	41.6	44.2
24	9.89	10.9	12.4	13.8	15.7	19.0	23.3	28.2	33.2	36.4	39.4	43.0	45.6
25	10.5	11.5	13.1	14.6	16.5	19.9	24.3	29.3	34.4	37.7	40.6	44.3	46.9
26	11.2	12.2	13.8	15.4	17.3	20.8	25.3	30.4	35.6	38.9	41.9	45.6	48.3
27	11.8	12.9	14.6	16.2	18.1	21.7	26.3	31.5	36.7	40.1	43.2	47.0	49.6
28	12.5	13.6	15.3	16.9	18.9	22.7	27.3	32.6	37.9	41.3	44.5	48.3	51.0
29	13.1	14.3	16.0	17.7	19.8	23.6	28.3	33.7	39.1	42.6	45.7	49.6	52.3
30	13.8	15.0	16.8	18.5	20.6	24.5	29.3	34.8	40.3	43.8	47.0	50.9	53.7

（橫書式）　國立中山大學八十七學年度碩博士班招生考試試題

科　目：植物分類學（兩組生科所選考）　共 1 頁 第 1 頁

一. 解釋下列各名詞（40%）

1. Taxonomic character
2. Natural classification system
3. Common name
4. Taxon
5. Habit
6. Leaf arrangement
7. Venation
8. Allopatric distribution
9. Directional natural selection
10. Geographical isolation

二. 為何分類學是一門綜合性（synthetic）之科學？10%

三. 同一種植物的同一族群（population）及不同族群間，個體外形不盡相同（有差異）的原因為何？10%

四. 標本的標籤上包含那些資料？5%

五. 寫出蕨類植物、裸子植物、雙子葉植物和單子葉植物中各五科之中文科名。10%

六. 將 Seed plants、Vascular plants、Dicotyledonous plants 和 Angiospermous plants 四群植物依所包含植物之範圍（或多寡）依序排列，範圍大的在前，小的在後。5%

七. 學名（scientific name）是如何組成的？5%

八. 將 Raceme、Corymb、Spike、Cyme、Panicle 五花序以簡圖繪出。5%

九. 寫出台灣木本植物及草本植物之拉丁學名各5種。10%

一、Multiple choice 單選題 75 pts.

1. Which of the following is not a character of all chordates?
1. bilateral symmetry
2. three germ layers
3. segmented body
4. bony endoskeleton

2. Linnaeus followed the _____ species concept.
1. typological
2. nominalistic
3. biological
4. evolutionary

3. Which school would partition characters into derived and ancestral?
1. numerical phenetics
2. cladistics
3. evolutionary classification
4. all of the above

4. If two taxa have the same name, it is treated as a
1. synonym
2. homonym
3. binonym
4. none of the above

5. Hominidae is a _____ name.
1. class
2. order
3. family
4. genus

6. Which of the following is false about birds' fertilization?
1. paired testes in the male
2. fertilization external
3. a single left ovary in the female
4. copulation usually a few seconds

7. The _____ refers to the birds' ride on the deflected air currents hitting a terrestrial ridge or ocean wave
1. thermal soaring
2. slope soaring
3. dynamic soaring
4. none of the above

8. Which of the birds have low wing loading?
1. passerines 燕雀
2. albatrosses 信天翁
3. divers 潛鳥
4. grebes 鷿鷉鳥

9. Most birds have mating system as
1. monogamy
2. polygyny
3. polyandry
4. none of the above

10. Which of the following is true about the respiratory system of birds?
1. large and spongy lungs
2. breath rate in flight is 12 to 20 times their normal resting rates
3. two-way air in and out
4. not efficient of gas exchange

11. Which of the following fly with neck folding into an S-shaped curve?
1. spoonbills 琵鷺
2. ibises 朱鷺
3. storks 鸛
4. none of the above

12. Which birds have stout bill with bristles, dark plumage and pointed wings?
1. drongos 卷尾
2. flowerpeckers 啄花鳥
3. white-eyes 繡眼
4. babblers 畫眉

13. Which birds have strong legs with sharp long, curved claws, and can run up and down tree-trunks?
1. tits 山雀
2. flycatchers 鶲
3. thrushes 鶇
4. nuthatches 鳾

14. Which of the following is not a member of the Order Piciformes 䴕形目?
1. woodpeckers 啄木鳥
2. barbets 五色鳥
3. toucans 巨嘴鳥
4. kingfishers 翠鳥

15. The following characters are true about the owls except
1. silent flight
2. neckless
3. nocturnal habits
4. syndactylous feet

16. The following characters are true about the tortoises 陸龜 except
1. hind legs elephantine
2. forelimbs with scales
3. high-arched shells
4. with some webbing on feet

17. Which is a member of the family Lacertidae 蜥蜴科？
1. *Mabuya logicaudata* 長尾南蜥
2. *Playplacopus kuehnei* 台灣地蜥
3. *Spehnomorphus boulengeri* 鮑氏挺蜥
4. *Eumeces chinensis* 中國石龍子

18. The snake *Naja naja* 眼鏡蛇 is in the family
1. Elapidae
2. Viperidae
3. Colubridae
4. Hydrophiidae

19. Which is true about the reptiles' sense organs?
1. The third eye exists in all reptiles.
2. Jacobson' organ aids in hearing.
3. Hearing is not important.
4. none of the above

20. The _____ refers the movements in fish using the caudal fin only.
1. Ostraciiform
2. Anguilliform
3. Carangiform
4. Balistiform

21. The following dwell only in freshwater except
1. *Plecoglossus altivelis* 香魚
2. *Anguilla marmorata* 鱸鰻
3. *Crossostoma lacustre* 台灣纓口鰍
4. *Clarias fuscus* 塘鱧魚

22. Which of the following have luminescent organs?
1. *Stomia* 廣(巨)口魚
2. Codfishes 鱈魚
3. cusk-eels 鼬魚
4. toadfishes 蟾魚

23. Which is false about the family Bufonidae?
1. stout body
2. no teeth
3. toes not webbed
4. skin covered with warts

24. Which of the following is a characteristic of the order Urodela?
1. no tails
2. no neck
3. two pairs of legs of similar size
4. vocal sacs in male

25. Which of the following has three hoofed toes on each foot?
1. Rhinoceros 犀牛
2. Tapir 貘
3. Horse
4. Zebra 斑馬

26. Monotrems include all of the following except the
1. echidnas 針鼴
2. platypus 鴨嘴獸
3. moles 鼴鼠
4. all of the above

27. Which of the following is not a plant-eater?
1. Sloth 樹獺
2. Flying-fox 狐蝠
3. Kangaroo 袋鼠
4. Mole 鼴鼠

28. All of the following are characteristics of the rodents except
1. continuously growing incisors
2. space between the incisors and cheek
3. one canine tooth
4. total teeth < 22

29. Which family does not belong to Prosimian group?
1. Lemuridae 狐猴科
2. Tarsiers 眼鏡猴科
3. Lorisidae 懶猴科
4. Cebidae 捲尾猴科

30. All of the following are baleen whales except the
1. gray whales 灰鯨
2. right whales 露脊鯨
3. sperm whales 抹香鯨
4. rorguals 鰛鯨

二、Questions 問答題 25 pts.
1. Describe and compare the reproduction of caecilians, salamanders and frogs. 10 pts

2. What are the differences between antlers, horns, and hair horns? Name one mammal that processes each of the above structures? 10 pts

3. Distinguish among the families Glareolidae (pratincole), Recurvirostridae (avocets) Jacanidae (jacansas). 5 pts