

科目：生物化學【生科系碩士班甲組、乙組】✓

問答題 (100 分)

1. Describe the levels of protein structure and how each level of protein structure is stabilized. (16 分)

2. The compounds listed below are often added to the buffer during protein extraction and purification. Describe the purpose of each addition. (12 分)

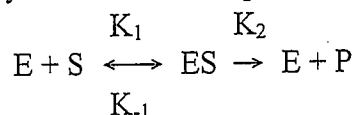
- | | |
|--|------------------|
| (1) DTT (dithiothreitol) | (2) Glycerol |
| (3) PMSF (phenylmethanesulphonylfluoride) | (4) Lysozyme |
| (5) EDTA (ethylenediaminetetraacetic acid) | (6) Triton X-100 |

3. Proteins are the most important agents of biological function. However, the function of more than 40% of the proteins encoded by human genome remains unknown. Based on your knowledge, propose how you study a protein of human genome with unknown function, starting with the genome information provided. (15 分)

4. Many compounds or drugs listed below have been used for studying the metabolic pathways or treating the medical problems. Describe the action or the effect of each compound. (12 分)

- | | |
|-----------------------|----------------|
| (1) 2,4-Dinitrophenol | (2) Malonate |
| (3) Allopurinol | (4) Lovastatin |
| (5) Aspirin | (6) Ouabain |

5. An enzyme-catalyzed reaction is expressed as below: (15 分)



E, S, and P are the enzyme, substrate, and product respectively; K_1 , K_2 , and K_{-1} are rate constants. The Michaelis-Menten equation $V = V_{\max}[S]/(K_m + [S])$ is derived based on the steady-state assumption.

- Define the steady-state.
 - Define the kinetic parameters K_m and V_{\max} .
 - Discuss the significance of K_m and V_{\max} .
 - Describe how to determine K_m and V_{\max} .
 - Most biochemical reactions involve at least two substrates. Can the rates of such reactions be analyzed by the Michaelis-Menten approach?
6. Describe the strategies that are used by organisms to help facilitate, control, and coordinate the metabolic reactions that occur within them. (15 分)
7. Describe the stages of glucose oxidation in eukaryotes. (15 分)

科目：分子生物學【生科系碩士班甲組選考、乙組選考】✓

I. 選擇題：請自下列 1~20 題選擇題各選出一正確答案。每題 3 分。

- The first eukaryotic RNA processing event is capping which involves formation of a specific structure that is characterized by
 - a guanosine joined by its 5' end to the first nucleotide of the RNA transcript.
 - a guanosine joined by its 3' end to the first nucleotide of the RNA transcript.
 - a nucleotide joined to and is used to start transcription.
 - a methylated guanosine joined to the first nucleotide of the RNA transcript by a 5'-5' triphosphate bridge.
 - a methylated guanosine joined to the first nucleotide of the RNA transcript by a 3'-5' triphosphate bridge.
- Which of the following organisms has the smallest genome in terms of number of genes?
 - Agrobacterium tumefaciens*
 - Mycoplasma genitalium*
 - Escherichia coli K-12*
 - Saccharomyces cerevisiae*
 - Streptococcus pneumoniae*
- The general recombination (also known as homologous recombination) is essential for all organisms because it involves in the following biological processes
 - DNA rearrangement
 - DNA repair
 - chromosome pairing and segregation
 - both A and C
 - all of the above
- Which of the following statements is correct?
 - tRNA genes are transcribed by RNA Pol I and the promoter comprises the core element and the upstream control element.
 - tRNA genes are transcribed by Pol III and the promoters comprises the core element and the upstream control element.
 - tRNA genes are transcribed by Pol I and the promoter is located downstream from the transcription start site.
 - tRNA genes are transcribed by Pol III and the promoter is located downstream from the transcription start site.
 - none of the above
- The incorporation of DNA into nucleosomes and thus the chromatin structure can have a profound impact on the expression of the genome. Which combination of the following complexes is critical to the regulation of chromatin structure?
 - core histones and linker histone
 - preinitiation complex and elongation complex
 - histone-modifying complex and nucleosome-remodeling complex
 - nucleosome positioning complex and nucleosome-remodeling complex
 - histone-modifying complex and preinitiation complex
- Which of the following enzymes can relax supercoiled DNA?
 - topoisomerases
 - DNA Pol II
 - spliceosomes
 - helicase
 - none of the above

科目：分子生物學【生科系碩士班甲組選考、乙組選考】

7. RNA splicing is essential for eukaryotic genes. It is a process that removes introns and joins exons in a primary transcript. What are the components required for accurate exon definition in long pre-mRNAs?
- (A) spliceosomes
(B) spliceosomes and hnRNPs
(C) CTD of RNA Pol II and snRNPs
(D) SR proteins, snRNPs, alternative splicing factors
(E) SR proteins, snRNPs, splicing factors
8. Most eukaryotic cells use a totally different way to replicate their chromosome ends which are termed telomeres. Which of the followings regulates telomere length and telomerase activity?
- (A) the catalytic subunit of telomerase reverse transcriptase, TERT.
(B) telomere-binding proteins (C) telomerase-associated proteins
(D) telomere structure (E) none of the above
9. Which of the following are steps in protein synthesis in prokaryotes?
- (A) binding of tRNA to a 70S ribosome. (B) binding of tRNA to a 30S subunit.
(C) binding of tRNA to a 50S ribosome subunit.
(D) coupling of an amino acid to ribosome by an aminoacyl synthetase.
(E) separation of the 70S ribosome to form 30S and 40S subunits.
10. A common feature of all transposable elements (also known as mobile DNA elements) is the presence of _____.
- (A) short direct repeats flanking the sequence. (B) short indirect repeat flanking the sequence.
(C) long terminal repeats flanking the sequence. (D) short terminal repeats flanking the sequence.
(E) none of the above
11. The excision repair of UV-induced DNA damage is defective in individuals suffering from _____.
- (A) hereditary nonpolyposis colon cancer (B) Crohn's disease
(C) xeroderma pigmentosum (D) lung cancer
(E) hereditary breast cancer
12. To study DNA repair system of a particular cell culture with or without a treatment, the following experiments may be performed
- (1) Western blot (2) Northern blot (3) PCR and sequencing
(4) RT-PCR (5) Ribonuclease protection assay
- (A) 1,3,5 (B) 2,3,4 (C) 1,3,4
(D) all of the above (E) none of the above
13. Which of the following methods might be used to determine the exact 5' end of an mRNA transcript?
- (A) primer extension (B) PCR (C) cloning
(D) Southern blotting (E) Northern blotting

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14. DNA repair systems and their corresponding genes
- (A) are found only in eukaryotic cells.
 - (B) may cause inactivation of oncogenes.
 - (C) include only nucleotide excision repair and base excision repair.
 - (D) that are defective are associated with increased probability of developing certain cancers.
 - (E) sometimes coupled with translation.
15. Which of the following statements about transcription are correct?
- (1) RNA synthesis occurs in the 3' to 5' direction.
 - (2) RNA polymerase moves along the sense strand of the DNA in a 5' to 3' direction.
 - (3) RNA polymerase moves along the template strand of the DNA in a 5' to 3' direction.
 - (4) the transcribed RNA is complementary to the template strand.
 - (5) RNA polymerase adds ribonucleotides to the 5' end of the growing RNA chain.
- (A) 1 and 3 (B) 2 and 4
(C) 1, 3, and 5 (D) 2, 4, and 5
(E) none of the above
16. Histones are the most abundant proteins associated with eukaryotic DNA. The histones have a high content of which of the following amino acids?
- (1) lysine (2) alanine (3) arginine (4) glycine (5) glutamine
- (A) 1 and 2 (B) 2 and 3
(C) 3 and 4 (D) 2 and 4
(E) 1 and 3
17. Alternative splicing may lead to expression of different mRNAs from the same gene in different cell types or at different developmental stages. Which of the following is/are the major regulator(s) during alternative splicing?
- (A) hnRNAs (B) spliceosomes
(C) splicing repressors and splicing activators (D) hnRNAs and spliceosomes
(E) all of the above
18. The melting temperature of DNA is the temperature where:
- (A) DNA anneals to RNA (B) DNA denatures into single strands
(C) DNA is degraded (D) RNA binds to the ribosome (E) transcription begins
19. Which of the following unusual bases is often present at the wobble position of the anticodon in a tRNA transcript?
- (A) inosine (B) dihydrouridine (C) pseudouridine
(D) ribothymidine (E) thiocytidine
20. Hydrolytic damage of cytosine to uracil is an example of which of the following types of DNA damage?
- (A) DNA alkylation (B) UV-light-induced DNA damage (C) Bulky DNA adduct
(D) DNA oxidation (E) None of the above

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II. 是非題：下列 21~30 題是非題：若是正確敘述請答 (○)；若是不正確敘述請答 (×)。每題 2 分。

21. Replication of DNA employs both DNA polymerases and RNA polymerase.
22. All prokaryotes have single circular chromosomes.
23. DNA synthesis occurs in the 5'-to-3' direction on the leading strand and in the 3'-to-5' direction on the lagging strand.
24. The two transcriptional processes, elongation and RNA processing, compose completely different sets of proteins for formation of functional complexes, respectively.
25. RNA is more sensitive to high pH than DNA and DNA is more sensitive to low pH than RNA.
26. The eukaryotic activators can interact with one or more of many different components of the transcriptional machinery.
27. Small regulatory RNAs are important agents of gene regulation and are only encoded by eukaryotes.
28. It is estimated that microRNAs regulate the expression of more than one-third of human genes, including many genes important in human cancers and other diseases.
29. RNA editing alters the sequences of pre-mRNAs and is found only in the mitochondria of protozoans and plants as well as in chloroplasts.
30. Because the 23S rRNA component of the large subunit catalyzes peptide bond formation in translation elongation, ribosome is called a ribozyme.

III. 問答題：每題 10 分。

31. Describe the concluding points from the following paragraph excerpted from the article 'Biological principles of microRNA-mediated regulation: shared themes amid diversity' published in Nature Reviews Genetics 2008 Nov;9(11):831-42.

"miRNAs have roles in diverse aspects of plant and animal biology, and careful consideration of how miRNAs are used suggests many parallels with transcription-factor-mediated gene regulation. There is a fundamental hierarchy to both of these systems. As miRNAs require an RNA substrate to repress, miRNA-mediated regulation acts downstream of transcriptional control. This does not necessarily mean that miRNAs are 'less important' than transcription factors. We discussed many examples in which transcriptional regulation is poorly suited or not applicable — for example, at synapses, for maternally deposited transcripts and for messages that require rapid reactivation. Nevertheless, even in these systems miRNAs are not the only solution: proteins can also direct the necessary regulation to great effect. We suggest that it is not constructive to focus on whether transcriptional, post-transcriptional or even post-translational strategies are 'best' for any particular system. Instead, the optimal operation of biological systems probably involves the coordinated use of multiple regulatory systems, and many of these will include a miRNA-mediated aspect. But one should bear in mind that the requirement for the miRNA input will vary widely among different settings."

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32. A phylogenetic analysis of a family of related protein or nucleic acid sequence is a determination of how the family members might have been derived during evolution. A student is interested in studying the phylogenetic analysis of the histone protein H3 of a special strain of *Arabidopsis thaliana*. The first step this student has to do is to clone this gene. How would be your suggestion for this student to clone this gene in a rapid and efficient way? Please outline your suggestion for performing this cloning experiment.

科目：動物生理學【生科系碩士班甲組選考】 ✓

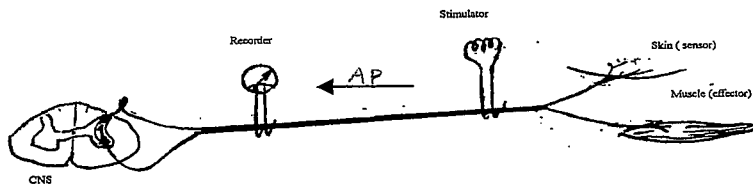
1. Describe the processes of the oxygen transportation from alveolar to muscle cells. (10%)

Questions 2 to 4 refer to muscle contraction mechanisms:

2. Describe briefly the sliding-filament theory of muscle contraction as was proposed by Huxley. (10%)
3. Draw schematically a 'length - tension curve' for a typical vertebrate sarcomere. (10%)
4. Describe the role of calcium ions and ATP molecules in cross-bridge attachment and releasing. (10%)

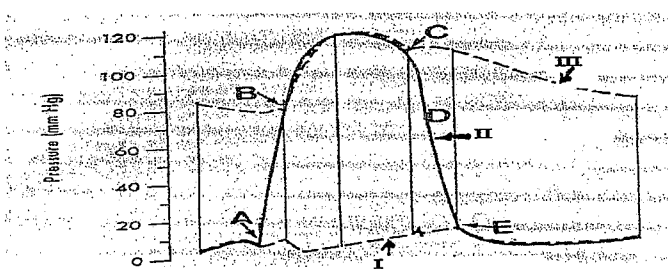
Questions 5 and 6 refer to compound action potential recordings.

When the distal part of a peripheral nerve is electrically stimulated (as shown in the following diagram which show schematically the setting of the experiment), a compound action potential should be recorded by an electrode located more proximally.



5. Draw schematically a neurograph containing a typical compound action potential that could be recorded from the experiment. (10%)
6. Describe waves shown in the graph and explain why they are different in both the amplitude and the latency. (10%)

Questions 7 to 12 refer to the following diagram (cardiac cycle events recorded in one cardiac contraction) :



7. Indicate wave numbers that may represent the pressure events of left atrium and ventricle. (5%)
8. Why do wave I fall down below wave II and III ? (5%)
9. At which point in the above diagram does the mitral valve start to open? (5%)
10. At which point in the above diagram are the mitral valves and aortic valves both closed? (5%)
11. Draw an EKG trace of the heart corresponding to the above cardiac cycle. (5%)
12. Which point in the above diagram is closest to the Q wave of the EKG? Explain why you think your answer is correct. (5%)
13. Describe the origin and its functions of catecholamine in mammals. (10%)

科目：免疫學【生科系碩士班甲組選考】 ✓

Answer the following questions on your ANSWER sheet:

1. Draw a diagram to show the stages in CTL-mediated killing of target cells. (10 分)
2. Explain why NK cells from a given host will kill many types of virus-infected cells but do not kill normal cells from that host. (10 分)
3. Discuss the use of bone marrow transplantation for the treatment of autoimmune diseases and effects of the treatment on autoimmunity. (20 分)
4. Describe the particular roles of toll-like receptors in inflammation. (20 分)
5. What are the major differences between transgenic mice and knockout mice and in the procedures for producing them? (20 分)
6. Name three types of professional antigen-presenting cells (APCs). APCs have been shown to present lysozyme peptide 46-61 together with the class II IA^K molecule. When CD4⁺ T_H cells are incubated with APCs and native lysozyme or the synthetic lysozyme peptide 46-61, T_H cell activation occurs. If chloroquine is added to the incubation mixture, presentation of the native protein is inhibited, but the peptide continues to induce T_H cell activation. Explain why this occurs. If chloroquine addition is delayed for 3 hr, presentation of the native protein is not inhibited. Explain why this occurs. (20 分)

科目：微生物學【生科系碩士班乙組選考】 ✓

★ 請務必依題號順序作答

1. New strains of influenza viruses periodically appear, causing epidemics. Define the terms of “antigenic shift” and “antigenic drift”. (15%)
2. Describe the bacterial cell wall in detail. Compare and contrast the cell wall of Gram positive and Gram negative bacteria. (15%)
3. What is the major difference between respiration and fermentation? (15%)
4. How are microbes classified based on oxygen requirements? What special enzymes allow aerobes to live and grow in an oxygen-rich environment? (15%)
5. What is the Ames test? What relationship does the Ames test have to auxotrophs? (20%)
6. Describe how each the following produce energy (ATP) and what their carbon source is: (20%)
 - A. photoautotrophs
 - B. photoheterotrophs
 - C. chemoheterotrophs
 - D. chemoautotrophs

科目：植物生理學【生科系碩士班乙組選考】

一、Please explain the following terms (30 points)

(1) polar transport (2) abscission zone (3) apoplast and symplast (4) casparian strip (5) phytochrome and cryptochrome (6) florigen (7) vernalization (8) photoperiod (9) phase change (10) secondary metabolites

二、Please answer the following questions (70 points)

1. Please compare the photosynthesis of C₃, C₄, and CAM plants. (10 points)
2. Plants can absorb water and nutrients with root system and transport them to the shoot system. Most of the water will be lost through stomata via transpiration. Please describe the route of water movement from root to the shoot and explain the possible mechanisms responsible for water movement. (10 points)
3. Please explain how auxin induces acid growth. (10 points)
4. Floral organ formation is regulated by many different developmental genes and can be predicted from ABC model proposed in *Arabidopsis*. Please explain how the ABC model can be used to predict the different floral organ formation. (10 points)
5. Lettuce seed dormancy and/or germination can be affected by light (red light and far-red light) mediated by phytochrome (Pr and Pfr) or plant growth hormone regulators, such as ABA, cytokinin, and GA. Please predict how these factors influence lettuce seed dormancy and/or germination. (10 points)
6. Drought is a serious problem in agriculture. When plant roots in the soil are exposed to drought stress, one of the quick responses in leaves is to close the stomata. Please explain the possible mechanism. (10 points)
7. In *Arabidopsis*, ethylene is the key factor involved in triple response of seedling during germination. Please describe the phenomenon of triple response and predict the possible phenotypes of *Arabidopsis* mutants with ethylene deficiency or insensitivity. (10 points)

科目：生態學【生科系碩士班丙組】✓

I. 解釋名詞，共 20 分（20%）

1. numerical response (5 分)
2. r selection (5 分)
3. community resilience (5 分)
4. net primary production (5 分)

II. 問答題，共 80 分（80%）

5. What kinds of factors influence biodiversity of an ecosystem? (20 分)
6. What are the short-term and long-term effects of climatic change? (20 分)
7. What advantages and disadvantages do C_4 plants have over C_3 plants? (20 分)
8. What are the influences of habitat fragmentation from the perspective of populations?
How do you think fragmentation will affect species richness? (20 分)

科目：植物分類學【生科系碩士班丙組選考】✓

一、解釋下列各應用於植物分類學上之名詞或術語（如有必要，可繪圖說明）
（60%）

1. achene
2. biodiversity hotspot
3. conserved name
4. dioecious
5. endemic species
6. founder effect
7. gynoecium
8. holotype
9. isozyme
10. Jackknife
11. karyotype
12. legume
13. marginal placentation
14. naturalized species
15. ontogeny

二、簡答下列各問題（40%）

16. 請列出台灣產的任意三種裸子植物之中文、學名及地理(或生態上)的分布。
17. 請列出裸子植物與顯花植物之間的至少四項區別。
18. 請列出至少四種台灣由海邊至高山地區因海拔不同而有的植群帶類型以及每一類這些植群帶的各一種代表植物。
19. 請敘述多倍體（polypoidy）在植物種化（plant speciation）上的可能作用。可以舉例說明。
20. 達爾文認為顯花植物之起源是一個可惡的謎題（abominable mystery），請寫出你所知道的對於此一謎題之解密進程（即至今科學家已經具有共識的顯花植物如何起源之部分知識）。

科目：生物統計學【生科系碩士班丙組選考】 ✓

For all questions, show how you obtain your answers.

1. A normally distributed population of grass height has a mean 40 cm and a standard deviation 10 cm. (20 pts)

- What proportion of the population is with a height 52 cm or longer?
- What is the probability of a piece of grass selected with a height between 25 and 35 cm?

2. Test whether the following variances are equal.

$$n_1 = 4 \quad s_1^2 = 15 \quad \text{and} \quad n_2 = 7 \quad s_2^2 = 30. \quad (10 \text{ pts})$$

3. The measurements of blood homocysteine level were taken from haemodialysis patients (CKD stage 1 and 2) and normal controls. (24 pts)

- Construct an ANOVA table to test whether the mean homocysteine levels are the same.
- Use the Bonferroni t test to compare the means.

CKD stage 1: 20, 25, 25

CKD stage 3: 30, 40, 42

Normal controls: 4, 5, 7

4. 100 argali sheep of different sex were observed for their preferences of parts of grass as food. (20 pts)

	<u>Male</u>	<u>Female</u>
roots	30	10
blades	10	50

- What is the odds ratio of male sheep on roots over females?
- Test whether the preference of parts of grass independent of sex?

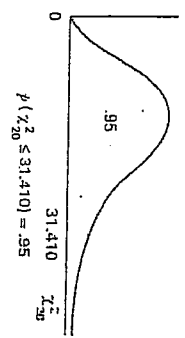
5. The following are the midterm and final examination grades of 6 students in biology. (26 pts)

Student	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Midterm	70	80	75	70	91	100
Final	85	70	85	90	80	95

- Is there a significant difference of mean grades between the two exams?
- What is the correlation of midterm and final grades? Is it a significant correlation?

科目：生物統計學【生科系碩士班丙組選考】

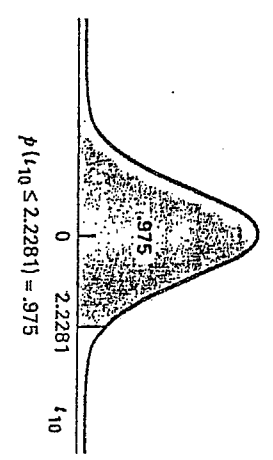
TABLE F Percentiles of the Chi-Square Distribution



$P(Z_0 \leq 31.410) = .95$

d.f.	$\chi^2_{.995}$	$\chi^2_{.99}$	$\chi^2_{.975}$	$\chi^2_{.95}$	$\chi^2_{.9}$	$\chi^2_{.8}$	$\chi^2_{.7}$	$\chi^2_{.6}$	$\chi^2_{.5}$	$\chi^2_{.4}$	$\chi^2_{.3}$	$\chi^2_{.2}$	$\chi^2_{.1}$	$\chi^2_{.05}$	$\chi^2_{.025}$	$\chi^2_{.01}$	$\chi^2_{.005}$
1	.0000393	.000982	.00393	2.706	3.841	5.024	5.991	7.879	10.828	13.838	16.919	20.090	23.582	27.154	31.526	35.554	39.331
2	.0100	.0506	.103	4.605	5.991	7.378	8.910	10.597	13.581	16.765	20.000	23.582	27.154	31.526	35.554	39.331	43.163
3	.0717	.216	.352	6.251	7.815	9.348	11.143	13.277	16.812	20.483	23.209	26.757	30.819	35.172	39.578	43.773	47.791
4	.207	.484	.711	7.779	9.488	11.143	13.277	16.812	20.483	23.209	26.757	30.819	35.172	39.578	43.773	47.791	51.982
5	.412	.831	1.143	9.236	11.070	12.832	15.086	18.548	22.302	25.758	29.298	33.182	37.464	41.755	46.416	50.625	54.558
6	.676	1.237	1.635	10.645	12.592	14.449	17.535	20.520	24.996	29.191	33.182	37.464	41.755	46.416	50.625	54.558	58.579
7	.989	1.690	2.167	12.017	14.067	16.013	18.475	21.955	26.757	30.778	34.805	39.331	43.773	48.757	53.542	57.633	61.678
8	1.344	2.180	2.733	13.362	15.507	17.535	19.985	23.589	28.599	32.909	36.781	40.991	45.645	50.154	54.578	58.932	63.167
9	1.735	2.700	3.325	14.684	16.919	19.023	21.666	25.589	30.578	34.903	38.885	42.929	47.791	52.336	56.578	60.921	65.154
10	2.156	3.247	3.940	15.987	18.307	20.483	23.209	26.757	32.909	36.191	39.902	44.781	49.997	54.578	59.342	63.691	67.789
11	2.603	3.816	4.575	17.275	19.675	21.920	24.725	28.599	34.805	38.167	41.902	46.979	52.336	57.154	61.755	65.657	69.657
12	3.074	4.404	5.286	18.549	21.026	23.336	26.217	29.300	36.191	39.331	43.773	48.755	54.578	59.342	63.691	67.789	71.921
13	3.565	5.009	5.892	19.812	22.362	24.736	27.902	30.819	37.154	40.154	44.668	50.154	56.578	61.755	65.657	69.657	73.667
14	4.075	5.629	6.571	21.064	23.685	26.119	29.141	31.319	38.578	41.154	45.755	51.423	57.921	63.163	67.154	71.423	75.902
15	4.601	6.262	7.261	22.307	24.996	27.488	30.578	32.801	39.789	42.302	46.902	52.789	59.342	64.668	68.789	72.902	77.921

Values of F_{α}



$P(Z_0 \leq 2.2281) = .975$

d.f.	$f_{.90}$	$f_{.95}$	$f_{.975}$	$f_{.99}$	$f_{.995}$
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	3.365	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

Degrees of freedom for denominator	Degrees of freedom for numerator																			
	1	2	3	4	5	6	7	8	9	10	12	15	20							
1	161	200	216	225	230	234	237	239	241	242	244	246	248							
2	18.5	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.4							
3	10.1	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66							
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	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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							
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							

科目：脊椎動物學【生科系碩士班丙組選考】✓

1. Distinguish the morphology of sharks and rays. What are common distinctive characteristics they share? (15%)
2. Compare the differences among the caecilians, salamanders and frogs. (15%)
3. What are the major distinguishing characteristics of skull of turtles, crocodiles, snakes, and lizards. What are the phylogentic relationships of these with birds? (18%)
4. Explain the following terms: passeriformes, polyandrous, waders, brood parasitism, zygodactyl feet, primaries, down feathers. (21%)
5. Compare and differentiate the morphological characteristics, habitat and food of Megachiroptera and Microchiroptera. (15%)
6. Compare between two schools of macrotaxonomy: numerical phenetics and cladistics. (16%)

科目：昆蟲學【生科系碩士班丙組選考】√

答題建議：

1. 本試卷僅有一題，總分 100，請詳讀試題，並留意對問題、策略、預測與結果陳述的條理與邏輯性
2. 若能引用若引述您所讀過的文獻以佐證您的想法更佳（不需詳列文獻完整來源）
3. 除文字敘述外，若能以簡單的圖表說明您的概念更佳

題目：

農委會將於 4 月 1 日公告新版本的「保育類野生動物名錄」，其中昆蟲的部份去除了渡邊氏長吻白蠟蟲、擬食蝸步行蟲與台灣食蝸步行蟲，但加入了蘭嶼與綠島所產的球背象鼻蟲全屬(*Pachyrhynchus*)以及綠島所產的碎斑硬象鼻蟲(*Kashotonus multipunctatus*)，以及黃胸黑翅螢(*Luciola hydrophila*)與鹿野氏黑翅螢(*Pristolycus kanoi*)。請您就標本交易、環境教育、法律執行、本土產業、生物地理、族群遺傳、演化、物種保育以及棲地保育的觀點說明一個物種在什麼樣的條件下應該藉由法律手段進行保育。