

國立臺灣師範大學 101 學年度碩士班招生考試試題

科目：普通生物學

適用系所：生命科學系

注意：1.本試題共 10 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則依規定扣分。

一、單選題(每題 1 分，共 50 分)

- The typical resting potential of an isolated neuron is
(A) -60 mV. (B) -70 mV. (C) -80 mV. (D) -90 mV.
- An enzyme that is able to transfer a phosphate group to another molecule is called
(A) kinase (B) enolase (C) polymerase (D) phosphotase
- The "pill" works primarily by
(A) blocking sperm from entering the uterus.
(B) stimulating the release of GnRH.
(C) inhibiting the release of FSH and LH.
(D) preventing implantation of the embryo.
- A tissue with one free surface with several layers of cells attached to a basal lamina is an example of
(A) connective tissue. (B) epithelial tissue. (C) muscle tissue. (D) nervous tissue.
- Which cells are located in the brain and spinal cord of vertebrates?
(A) interneurons (B) motor neurons (C) afferent neurons (D) efferent neurons
- Which organ system includes the pituitary, thyroid, and adrenal glands?
(A) endocrine system
(B) reproductive system
(C) lymphatic system
(D) respiratory system
- The ribs and sternum are considered to be part of
(A) both the axial skeleton and the appendicular skeleton.
(B) the axial skeleton.
(C) neither the axial skeleton nor the appendicular skeleton.
(D) the appendicular skeleton.
- Binding of the peptide hormone insulin to its receptor tyrosine kinase results in each of the following cellular activities EXCEPT _____.
(A) cell division (B) glucose uptake (C) photosynthesis (D) cell growth
- The purpose(s) of the pulmonary circuit in a closed circulatory system is to

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- (A) collect and distribute blood to heart itself.
 - (B) take blood to and from all parts of the body.
 - (C) take blood to and from the lungs.
 - (D) both (B) and (C)
10. Cell walls are found in ____.
- (A) animal cells only
 - (B) plant cells only
 - (C) fungal cells only
 - (D) plant and fungal cells
11. Which two structures (found in different organisms) both serve to increase the absorptive surfaces of the intestines?
- (A) choanocytes and gastric ceca
 - (B) typhlosoles and villi
 - (C) proventriculus and villi
 - (D) typhlosoles and gastric ceca
12. Helper T cells secrete ____, which activate B cells and stimulates their proliferation.
- (A) antigens
 - (B) interleukins
 - (C) antibodies
 - (D) interferons
13. How is antibody-mediated immunity different from cell-mediated immunity?
- (A) Antibody-mediated immunity requires lymphocytes; cell-mediated immunity does not.
 - (B) Antibody-mediated immunity is innate; cell-mediated immunity is not.
 - (C) Antibody-mediated immunity is adaptive; cell-mediated immunity is not.
 - (D) Antibody-mediated immunity requires both B and T cells; cell-mediated immunity requires T cells but not B cells.
14. The membrane potential across a cell creates a ____ charge inside the cell and a ____ charge outside the cell.
- (A) negative; negative
 - (B) negative; positive
 - (C) positive; positive
 - (D) positive; negative
15. In humans, spermatogenesis differs from oogenesis in that
- (A) spermatogenesis involves meiosis, while oogenesis involves mitosis.
 - (B) spermatogenesis begins at birth, while oogenesis begins at puberty.
 - (C) spermatogenesis has unequal cytoplasmic divisions, while oogenesis does not.

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- (D) spermatogenesis continues throughout a male's life, while oogenesis ends at menopause.
16. The enzyme lysozyme offers protection from
(A) bacteria. (B) viruses. (C) fungi. (D) viruses and bacteria.
17. Once transduction of a signal is complete, the receptor and its bound signal molecule are removed from the cell surface by _____.
(A) hydrolysis (B) diffusion (C) endocytosis (D) exocytosis
18. Select the endocrine gland whose secretory function is under direct control of the sympathetic preganglionic neuron.
(A) pancreas (B) thyroid (C) adrenal medulla (D) adrenal cortex
19. The development of an HIV vaccine has been very difficult because
(A) the virus has no antigens to target.
(B) the viral antigens are hidden by the capsid.
(C) the viral coat antigens change frequently as the virus replicates.
(D) the virus produces enzymes that destroy the vaccine.
20. The interior surface area of mitochondria is greatly increased by _____.
(A) cristae (B) the matrix (C) centrioles (D) microfilaments
21. Adjacent animal cells utilize _____ to rapidly communicate with each other.
(A) gap junctions (B) neurotransmitters (C) hormones (D) desmosomes
22. What directly supplies the electrons for the electron transfer system?
(A) ATP and ADP
(B) FADH₂ and NADH
(C) pyruvate and acetate
(D) oxygen and water
23. _____ are molecules that regulate defense responses via signal transduction pathways.
(A) Complement (B) Histamines (C) Prostaglandins (D) Cytokines
24. Aquaporins are
(A) cells that are specialized for water transport.
(B) transport channels for water.
(C) the entry point of filtrate into a nephron.
(D) transport channels for ions.

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25. ____ is the net movement of uncharged molecules from a low concentration to a higher concentration.
(A) Active transport (B) Facilitated diffusion (C) Diffusion (D) Osmosis
26. If a sieve tube in a plant becomes blocked, the plant will experience difficulty in
(A) carrying on transpiration.
(B) transporting minerals.
(C) translocating sucrose.
(D) completing cell division and experiencing normal growth.
27. Adventitious roots are associated with
(A) stems.
(B) fibrous root systems.
(C) taproot systems.
(D) fibrous root systems and stems only.
28. Which of the following statements is FALSE?
(A) There are more stomata on the upper epidermis of most leaves than on the lower epidermis.
(B) The greatest amount of photosynthesis takes place in the palisade mesophyll.
(C) The palisade mesophyll is more densely packed than the spongy mesophyll.
(D) The surface area of the root system is greater than that of the shoot system.
29. Chlorosis of young leaves is caused by a deficiency of
(A) zinc. (B) nitrogen. (C) magnesium. (D) iron.
30. Carbon dioxide enters the plant
(A) when transpiration stops.
(B) when potassium ions leave the guard cells.
(C) when the guard cells are stimulated by blue light.
(D) when the guard cells lose water and the stomata open.
31. During early spring, when leaves are beginning to develop, the source region for the pressure-flow translocation of organic compounds is the
(A) flower. (B) leaf. (C) stem. (D) root.
32. The sporophyte generation
(A) is essential for a flowering plant to complete its life cycle.

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- (B) is the only generation in higher plants.
(C) is microscopic in the flowering plants.
(D) is the dominant generation in the lower plants.
33. The calyx is composed of
(A) petals. (B) sepals. (C) anthers. (D) stigmas.
34. Seeds include all of the following EXCEPT
(A) seed coats. (B) cotyledons. (C) integuments. (D) endosperm.
35. Which of these events occurs first in seed germination?
(A) Release of gibberellins.
(B) Transcription of the amylase gene.
(C) Digestion of endosperm starch into transportable sugars.
(D) Imbibition of water.
36. Seed banks
(A) preserve seeds for museums.
(B) provide a source of seeds for farmers.
(C) distribute seeds to member seed companies.
(D) preserve plant genetic diversity to be tapped by genetic engineers.
37. Which hormone can be used to prolong the shelf life of cut flowers?
(A) Auxins. (B) Abscisic acid. (C) Cytokinin. (D) Ethylene.
38. Which of the following statements regarding the polar transport of auxin in a seedling is false?
(A) Basipetal transport in the shoots.
(B) Acropetal transport in the shoots.
(C) Basipetal transport in the roots.
(D) Acropetal transport in the roots.
39. Which of the following terms refers to the change in relative day length?
(A) Photoperiodism. (B) Phototropism. (C) Photorhythmic. (D) Photochrome.
40. Which of the following modification of histones usually causes tight nucleosomes and essentially preventing transcription?
(A) Phosphorylation. (B) Acetylation. (C) Ubiquitylation. (D) Sumoylation.
41. The insertion of how many nucleotides into a genetic sequence does less damage to the code

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than the insertion of other numbers of nucleotides?

- (A) 1. (B) 2. (C) 3. (D) 4.

42. The positive control of the lactose operon in bacteria is

- (A) activated by a repressor protein.
(B) activated by the CAP.
(C) regulated by RNA polymerase.
(D) independent of glucose concentration.

43. Which of the following enzymes join the paired sticky ends of DNA fragments?

- (A) DNA ligases. (B) DNA polymerases. (C) Restriction enzymes. (D) Gyases.

44. Which event may occur in all viruses, prokaryotes, and eukaryotes?

- (A) aneuploidy. (B) translocation (C) duplication. (D) mutation.

45. Karyotyping involves taking pictures of chromosomes during

- (A) prophase. (B) telophase. (C) metaphase. (D) anaphase.

46. Fred Griffith's experiments with two strains of *Streptococcus pneumoniae*

- (A) demonstrated that rough (R) bacteria cause pneumonia.
(B) demonstrated that mice can transform harmless bacteria into pathogenic bacteria.
(C) resulted in a vaccine against bacterial pneumonia
(D) provided evidence that genetic material from one bacterial strain can be transferred to that of another strain.

47. If nondisjunction occurs during meiosis I,

- (A) all gametes will lack a chromosome and be infertile.
(B) diploid cells are produced.
(C) one-half of the resulting cells are $n + 1$, and the other half are $n - 1$.
(D) only one half the gametes are affected.

48. Mendel would not have seen four different phenotypes in the F_2 generation of his dihybrid crosses if

- (A) more than two traits were traced.
(B) the genes were on the same chromosomes.
(C) purple was dominant to white.
(D) the P_1 generation was homozygous.

49. Cytoplasmic division in animal cells involves all except

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- (A) formation of a cell plate.
- (B) a contractile ring mechanism.
- (C) a deepening cleavage furrow.
- (D) a ring of actin filaments under the plasma membrane at the equator.

50. Crossing over is one of the most important events in meiosis because

- (A) it produces new combinations of alleles on chromosomes.
- (B) homologous chromatids must be separated into different daughter cells.
- (C) homologous chromosomes must be separated into different daughter cells.
- (D) the number of chromosomes allotted to each daughter cell must be halved.

二、簡答題(共 45 分)

請閱讀以下文章據以回答題目 1~3：

◎由於冷血動物的新陳代謝率低，所以浪費掉的熱能也很少，一般來說，從攝入的食物中，溫血動物只能轉換 2% 左右的能量成為自己的體質，而冷血動物的轉換率多在 50% 左右，這樣的特性使牠們可以充分的將食物轉換成生長或生殖上所需的物質。當食物不足時，牠們耐飢餓的能力也遠大於溫血動物，尤其在食物來源很不穩定或食物每年只短暫出現一次的環境，冷血動物仍可以生存，但溫血動物就不一定能撐得下去。在體型的變化上，冷血動物也幾乎沒有限制，不管是在大小的尺度上或體型的變化上，牠們都可以充分發揮。相對的，溫血動物的體型大小有明顯的限制，形狀上也不可能太細長或扁平，因為愈偏離圓形，相對的表面積就愈大，體溫和能量的散失也愈快。這些特別小、扁或細長的體型，讓冷血動物更能充分利用生態系的不同區位，也豐富了地球的生物多樣性。

已知爬行動物約出現在古生代的上石炭紀，並在中生代稱霸地球，而哺乳類約出現在中生代並在新生代時達到非常興盛的狀態。研究人員在古生代的岩層中發現一些掠食者和被掠食者的骨骼化石，經估算各自的體重後，算出掠食者的總體重和被掠食者的總體重比值為 50:100。另外他們在新生代的岩層內也找到許多哺乳類的化石，用同樣的方法，他們估算出掠食者哺乳類和被掠食者哺乳類的總體重比值為 2:100。請回答下列問題。

1. 一個池塘生態系內，其初級、次級和三級消費者分別是浮游動物、蝦蟹和魚類，則初級、次級和三級消費者三者之間的總體重比應最接近下列何者?(3 分)
 - (A) 1:10:100
 - (B) 1:50:500
 - (C) 100:50:25
 - (D) 100:50: 1
2. 假如地球上現生的生態系，消費者能量金字塔的底角為 45° ，則地球在古生代的生態系中，消費者能量金字塔的底角應如何?(3 分)
 - (A) $=45^\circ$
 - (B) $>45^\circ$

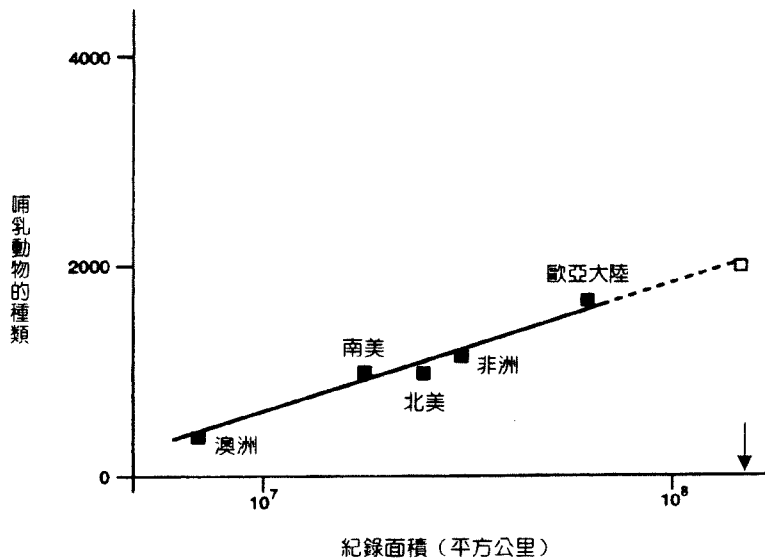
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- (C) $< 45^\circ$
(D) $< 45^\circ$ 但 $> 10^\circ$

3. 聯合國近年在推廣吃昆蟲救地球，其道理是什麼？(4分)

請閱讀以下文字及圖表以回答題目 4~7：

◎下圖為各大陸的面積和其哺乳類的種類數，而箭頭所指的位置是全球陸地面積的總合，已知全球的哺乳類目前約有 4000 種。



4. 如果全球陸塊會合在一齊，請預測哺乳類的種類數會有何改變？(2分)
5. 並請說明原因 (3分)
6. 人類的何種活動對生物多樣性造成的影響類似陸塊會合效應？(2分)
7. 並請說明原因 (3分)
8. 生物學上很好的種鑑定特徵往往對親緣關係研究而言沒有價值，為什麼？(4分)
9. 支序學研究者認為「活化石」這個概念是不正確的，請解釋。(4分)

請閱讀以下文字及圖表據以回答問題 10~14：

◎傳統分類把下頁圖中的分類單元歸群如下：

喙蝶科: Libytheinae

斑蝶科: Tellervinae, Danainae, Ithomiinae

蛺蝶科: Kallimini, Melitaeini, Nymphalini, Coeini, Argynnini, Vindula/Cethosia, Cyresttini, Limenitidini, Aparturinae, Chaeaxinae, Bia, Calinaginae, Biblidinae

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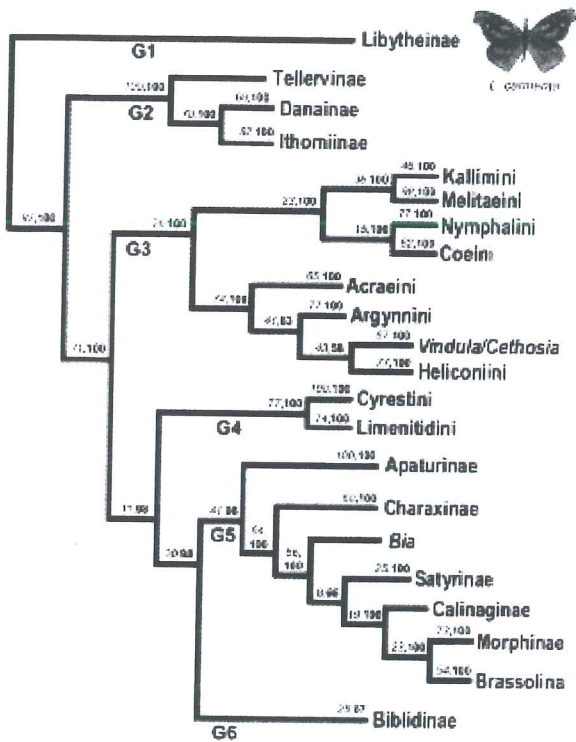
珍蝶科: Acraeini

毒蝶科: Heliconiini

眼蝶科(蛇目蝶科): Satyrinae

摩爾浮蝶科: Morphinae

鴉蝶科: Brassolinae



10. 根據以上說明，指出圖中傳統分類中的科級分類單元的蛺蝶科、眼蝶科、斑蝶科分別為單系群、並系群或複系群中哪一類型 (3 分)：

11. 依據此圖分類單元 Satyrinae 的姐妹群為？(2 分)

12. 依據此圖分類單元 Biblidinae (G6) 的姐妹群為？(2 分)

13. 依據此圖分類單元 Danainae 的姐妹群為？(2 分)

14. 依據此圖分類單元 Libytheinae (G1) 的姐妹群為？(2 分)

15. Long distance dispersal 形成的 colony 如果成功建立族群，其遺傳組成和母族群通常有何差異？(4 分) 這樣的差異符合微演化成因中的哪一項？(2 分)

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三、配合題（每題 1 分，共 5 分）

科學家於 1977 年在加拉巴哥 2600 公尺深的海底發現一些海底熱氣孔，其周圍有豐富的生命，包括管虫、螃蟹、二枚貝、魚和許多自營菌，有些種類的自營菌共生於完全沒有攝食構造的管虫體內，有些種類的自營菌則懸浮在熱氣孔附近，螃蟹以剪食管虫的組織為食，二枚貝濾食浮游的自營菌，魚類則以螃蟹為食，且已知自營菌利用熱氣孔噴出的硫化氫將水中的 CO_2 固定成有機碳。請根據以上的描述將左列的深海生物，依生態系對應的關係連結到右列的答案。（每個答案可能不只使用一次而且不一定每個答案都會用到，但每種深海生物都有一個對應的答案）

深海生態系

1. 管虫體內共生的自營菌
2. 浮游的自營菌
3. 二枚貝
4. 管虫
5. 螃蟹

陸地生態系

- 綠色植物
- 葉綠體
- 青蛙
- 蝗蟲
- 蛇