

國立臺灣師範大學 100 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 8 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，否則不予計分。

一、單選題 (第 1 至 10 題，每題 1.5 分；11 至 43 題，每題 2 分，總共 81 分)

- Which of the following is most likely the cause of the current extinction crisis?
(A) asteroid impact (B) human activity (C) adaptive radiation
(D) tectonic activity (E) climate change
- Four of the five practices listed below are approaches to biodiversity conservation. **Select the exception.**
(A) riparian ranching (B) strip logging
(C) introduction of exotic species (D) research on species hot spots
(E) study of indicator species
- Which is the taxon shown here with the greatest number of named species?
(A) vertebrates (B) insects (C) mollusks (D) plants (E) fungi
- Which in the following statement about the El Niño is true?
(A) increases global warming (B) stabilizes world climates
(C) produces a fluctuation in global climates (D) depletes the ozone layer
(E) increases oceanic productivity
- Which of the following is omnivorous but may be also a primary carnivore?
(A) chicken (B) cow (C) rabbit (D) red fox (E) squirrel
- Which of the following combinations of organisms can survive in isolation from other forms of life?
(A) producers and decomposers (B) producers and carnivores
(C) carnivores and decomposers (D) carnivores and parasites
(E) producers and parasites
- Fruit flies probably have what type of relationship with humans?
(A) parasitic (B) mutualistic (C) obligate (D) commensal (E) saprobic
- The range of all factors that influence whether a species can obtain resources essential for survival and reproduction, what is the term?
(A) habitat (B) niche (C) carrying capacity (D) ecosystem (E) community
- Which of the following is **NOT** true regarding factors that affect the dispersion of organisms in nature?
(A) Most environmental resources are randomly distributed
(B) Biological conditions tend to be non-uniform
(C) Dispersal of offspring is often limited or controlled by environmental factors
(D) The development of societies in some populations controls distribution
(E) Every species is adapted to specific environmental conditions

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10. Which of the following is **NOT** involved in capture-recapture methods of population sampling?
(A) DNA fingerprinting (B) tags (C) collars (D) leg rings (E) wing markers

(以下每題 2 分)

11. Below freezing and above boiling, cells are unable to function as "liquid machinery." However, most organisms' cells are still limited from functioning throughout this full range of liquid temperatures. At the molecular level in different organisms, cells' ability to vary in their tolerance to temperature, etc., is most closely related to variation in
(A) enzyme activity and protein denaturation. (B) ATP efficiency.
(C) ability to form glucose polymers. (D) replication of nucleic acids.
(E) extent of saturation of fatty acids.
12. Which cytoskeletal element is **NOT** correctly associated with its characteristic?
(A) Cilia are small extensions of membrane-surrounded microtubules.
(B) Microtubules are made up of a globular protein called tubulin.
(C) Centrioles are found in the microtubule organizing centers of plants.
(D) Flagella have a 9 + 2 pattern of microtubule structure.
(E) Basal bodies are located at the base of cilia and flagella.
13. All life forms currently have a basic cell membrane so we presume that the earliest forms of life had this "fence" isolating the internal organization from the external chaos. It is likely that the primordial environment was acidic. In such a case, the cell membrane would have to include
(A) a sodium (Na^+) pump. (B) a proton (H^+) pump.
(C) mitochondria underneath in order to provide energy for active transport.
(D) an acid-proof cell wall. (E) a totally nonpermeable membrane.
14. From the following table of free energy exchange, it is obvious that

Reaction	Standard free-energy change (kcal/mol)
$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{Sugar} + 6\text{O}_2$	+686
$\text{sugar} + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$	-686
$\text{ATP} + \text{H}_2\text{O} \rightarrow \text{ADP} + \text{P}$	-7.3
$\text{Maltose} + 6\text{H}_2\text{O} \rightarrow 2 \text{Glucose}$	-4.0

- (A) photosynthesis and cellular respiration have essentially the same amount of free energy generated or released.
(B) free energy is released in all of these reactions except photosynthesis.
(C) where the free energy is negative, formation of the products is more likely.
(D) All of the choices A, B, C are true.
(E) None of the choices A, B, C are true.

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15. For fatty acids to enter the citric acid cycle of aerobic respiration, the fatty acids must be:
- (A) deaminated.
 - (B) combined with glycerol.
 - (C) combined with ATP.
 - (D) converted to acetyl groups.
 - (E) converted into five-carbon sugars.
16. Cardiac muscle cells are bound end to end by intercalated disks, which may be described as
- (A) thin extensions of bone cells within canaliculi.
 - (B) specialized, striated cells with multiple nuclei.
 - (C) areas where folded plasma membranes between cells contain adhesion junctions and gap junctions.
 - (D) small spaces separated by matrix.
 - (E) None of above.
17. Which of the following statements about an action potential is **NOT** true?
- (A) An action potential takes 2 to 5 seconds.
 - (B) Repolarization occurs when potassium leaves the axon.
 - (C) There is a rapid change in polarity from about -65 mV to about +40 mV during depolarization.
 - (D) Depolarization occurs when sodium gates open and allow sodium ions to enter the axon.
 - (E) Potassium gates open after the sodium gates and allow potassium ions to leave the cell.
18. Mail-order catalogs often advertise a device for repelling irritating insects. One device has a frequency range from 30,000 to 65,000 cycles per second (Hz). Humans hear from roughly 50 to 15,000 cycles per second. In designing an experiment to determine if this device actually does repel a certain insect, what question(s) should you ask?
- (A) Is the target insect able to perceive a sound between these frequencies?
 - (B) Does the insect approach this sound device at a rate higher than random chance?
 - (C) Does the insect move away from this sound device at a rate higher than random chance?
 - (D) Does the insect produce any sounds within this range that would lead to a biological function to perceiving such frequencies?
 - (E) All of the choices are correct.
19. Which is an example(s) of negative feedback?
- (A) Nursing action stimulates the hypothalamus to release oxytocin that triggers mammary gland milk production.
 - (B) When the blood becomes dilute, ADH is no longer released from the hypothalamus.
 - (C) Uterine stretching sends nerve impulses to the hypothalamus that releases oxytocin that stimulates uterine contraction.
 - (D) FSH and LH stimulate the gonads to produce sperm or eggs.
 - (E) Both A and C are correct.

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20. Which of the following regarding muscle is **NOT** true?
- (A) Structures are correctly organized from large to small: muscle, muscle cell, myofibril, sarcomeres, filaments
 - (B) Actin and myosin filaments are both present in the dense region called the A band
 - (C) Correct order that a motor nerve impulse travels: motor nerve–synaptic cleft–sarcolemma–sarcoplasmic reticulum–troponin
 - (D) Actin binds ATP and breaks it apart as actin pulls against myosin.
 - (E) A maximal sustained muscle contraction is called tetanus.
21. What two forces control the movement of fluid through the capillary wall?
- (A) the thickness of the capillary wall and the number of cilia
 - (B) blood pressure and osmotic pressure
 - (C) the oxygen and nitrogen concentration
 - (D) the number of veins and arteries
 - (E) None of above
22. How do insects overcome the inefficiency of their hemolymph flow in taking oxygen to their tissues?
- (A) Their respiratory system consists of tracheae, which are tiny air tubes that take oxygen directly to the cells.
 - (B) Their bodies are tubular, thus increasing the body surface area where gaseous exchange takes place.
 - (C) A countercurrent mechanisms ensures that the maximum amount of oxygen is absorbed from the environment.
 - (D) Insects have highly vascularized extensions of their body walls, called parapodia.
 - (E) None of above
23. Which is **NOT** a function of the urinary system?
- (A) monitoring and maintaining blood pH
 - (B) regulating blood pressure by regulating salt balance in the blood
 - (C) elimination of nitrogenous wastes including urea, uric acid, and creatinine
 - (D) hormone secretion to stimulate red blood cell production and regulate sodium ion levels
 - (E) production of water from oxygen and bicarbonate ions (HCO_3)
24. Which of the following statements about reproduction is **NOT** true?
- (A) Gametes are produced by meiosis and may be specialized as eggs or sperm.
 - (B) Hydras may reproduce asexually by budding new individuals from the parent.
 - (C) Asexual reproduction is most advantageous when the environment is continually changing.
 - (D) A hermaphrodite produces both male and female gametes in different specialized gonads.
 - (E) A starfish can be cut into several pieces, and each piece will regenerate all the other parts of the individual.

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25. Luteinizing hormone (LH) triggers ovulation in females. What is its role in males?
- (A) It does not exist since males lack ovaries.
 - (B) It exists in rudimentary levels since LH is made by the anterior pituitary.
 - (C) It controls sexual behavior.
 - (D) It binds to Sertoli cells and controls production of inhibin.
 - (E) It binds to Leydig cells and controls production of testosterone.
26. What statement about homeotic genes is **NOT** true?
- (A) Homeotic genes are found in many different organisms.
 - (B) Homeotic genes code for translational factors that bind to mRNA.
 - (C) Each homeotic gene has a variable region and a sequence called the homeobox.
 - (D) The homeobox codes for a homeodomain which is the DNA-binding portion of the transcriptional factor.
 - (E) All homeotic genes are thought to be derived from an original DNA sequence that has been highly conserved in evolution.
27. What is the most important activity during the “gap” phases of the cell cycle?
- (A) DNA replication.
 - (B) Nuclear membrane synthesis.
 - (C) Resting for the next step.
 - (D) Sorting the chromosomes.
 - (E) Synthesis of cytoplasmic organelles.
28. Which of the following statements is **FALSE**?
- (A) Checkpoint gene products that inhibit mitosis are called proto-oncogenes.
 - (B) Metastasis is the invasion of cancer cells into normal tissue.
 - (C) Malignant tumors differ from benign tumors in that their cells migrate.
 - (D) Cancer cells have lost the ability to stop dividing.
 - (E) The parent cell that started a cancer may have undergone a checkpoint gene mutation.
29. When are the paired homologous chromosomes found at the spindle equator?
- (A) Prophase I.
 - (B) Metaphase I.
 - (C) Anaphase I.
 - (D) Metaphase II.
 - (E) Anaphase II.
30. What does a testcross consists of?
- (A) A cross of two pure-breeding forms to find out which form of a gene is dominant.
 - (B) A cross of two F2 individuals to produce an F3 generation.
 - (C) A cross of an organism of dominant phenotype but unknown genotype to an individual that is homozygous recessive for that trait.
 - (D) A cross between two unknown forms to determine their genotypes.
 - (E) A cross between an offspring and its homozygous dominant parent.
31. If one parent has type A blood and the other parent has type B, then which of the following is possible in the children?
- (A) Only AB.
 - (B) A and AB.
 - (C) B and AB.
 - (D) A, B, AB, and O.
 - (E) Only O.

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32. A woman heterozygous for color blindness (an X-linked recessive allele) marries a man with normal color vision. What is the probability that their second child will be color blind?
(A) 0%. (B) 12.5%. (C) 25%.
(D) 37.5%. (E) 50%.
33. What is the primary function of DNA ligase?
(A) It cuts the two strands of the DNA molecule prior to replication.
(B) It seals new short stretches of nucleotides into one continuous strand.
(C) It attaches free nucleotides to the growing chain.
(D) It removes bases that might be inserted incorrectly.
(E) It fragments old DNA that is no longer of use to the cell.
34. If the mRNA triplets are 5'-ATG-CGT-3', what is the sequence on its corresponding tRNA anticodons?
(A) 5'-ACGCAU-3'. (B) 5'-AUGCGU-3'. (C) 5'-ATGCGT-3'.
(D) 5'-UACGCA-3'. (E) 5'-TACGCA-3'.
35. The conversion of proteins by the removal of a portion of polypeptide chain is an example of
(A) transcriptional control. (B) transcript processing control.
(C) transport control. (D) translational control.
(E) post-translational control.
36. In knockout experiments, which of the following statement is true?
(A) The genes are removed from chromosomes.
(B) Normal genes are replaced physically by mutated genes.
(C) Wild type genes are mutated to prevent their transcription or translation.
(D) The mRNAs are prevented from attaching to ribosomes.
(E) The protein products of specific genes are inactivated.
37. What is the major purpose to use DNA chips?
(A) To sequence DNA. (B) To use in DNA fingerprinting.
(C) To use in electrophoresis. (D) To determine which genes are being expressed.
(E) To use in polymerase chain reaction.
38. Which of the following is true of monocots?
(A) They have two cotyledons.
(B) Floral parts are in multiples of fours and fives.
(C) Pollen grains contain three pores.
(D) Leaf veins are usually netlike.
(E) Vascular bundles are scattered throughout stem ground tissue.
39. Movement of soluble organic material through sieve tube members occurs through
(A) active transport. (B) cohesion-tension. (C) translocation.
(D) transpiration. (E) facilitated transport.

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- ()7. A species that influences community structure in disproportionately large ways relative to its abundance.
- ()8. A major biogeographic pattern. Only species adapted for long-distance dispersal are potential colonists of islands far from their home range.
- ()9. Maximum number of individuals of a species that a particular environment can sustain.

名詞庫：

代號	名詞	代號	名詞
1	population size	16	age structure
2	Immigration	17	Emigration
3	carrying capacity	18	Doubling time
4	per capita	19	survivorship curve
5	total fertility rate (TFR)	20	competitive exclusion
6	pioneer species	21	warning coloration
7	area effect	22	keystone species
8	Camouflage	23	Cannibalism
9	exotic species	24	Primary succession
10	Altruistic behavior	25	global warming
11	intermediate disturbance hypothesis	26	Cohort
12	inclusive fitness	27	Biogeography
13	Habituation	28	Detritivore
14	sexual selection	29	distance effect
15	reproductive success	30	zero population growth

三、 名詞解釋（每題 2 分，共 10 分）

- | | |
|-------------------|-----------------|
| 1、Mimicry (mimic) | 2、Pheromones |
| 3、Cannibalism | 4、Parasitoidism |
| 5、Detritivore | |