

(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

(海生所)科

目：生物學(單選題，每答對一題得1.25分，答錯不倒分) 四頁 第一頁

Please arrange your answers in the following way to expedite the process of grading, or risk losing points.

1	11	21	31	41	51	61	71
2	12	22	32	42	52	62	72
3	13	23	33	43	53	63	73
4	14	24	34	44	54	64	74
5	15	25	35	45	55	65	75
6	16	26	36	46	56	66	76
7	17	27	37	47	57	67	77
8	18	28	38	48	58	68	78
9	19	29	39	49	59	69	79
10	20	30	40	50	60	70	80

Do not write answers on this page!  
Write them on the answer sheet.

Choose one most appropriate answer to each question

1. A heritable mutation can be produced if there is an alteration of the a) ribosomal structure of a germ cell b) kinase structure in the chromosome of a germ cell c) DNA subunit structure in a somatic cell d) DNA subunit structure in a germ cell e) DNA subunit structure in both somatics and germ cells

2. Aerobic respiration results in more ATP formation per unit of glucose than does fermentation because a) The enzymes involved in the former are more efficient b) the alcohol produced by the latter slows the metabolism of the cell c) all the carbon can be oxidized to carbon dioxide in aerobic respiration d) the former combines the energy of oxygen with energy of the carbohydrates e) the latter produced lactic acid, which is a cell poison

Questions 3-7 What is the relationship between underlined species a) allelopathy b) competition c) mimicry d) mutualism e) parasitism f) predation

3. E. coli live in the large intestine of human

4. Many flowers may be pollinated by bats and only by bats

5. Two species of butterflies in different genera look similar in wing pattern but differ in palatability to bird predators

6. Two species of birds both feeding on plant seeds between the size of 1-10 mm

7. Self-thinning in plants and some benthos

8. If one Barr body is found in each of a person's liver cells, one would conclude that this person a) is a triploid b) is a male c) is a female d) has Down's syndrome e) has Werner's disease

Question 9-13 a) biotic potential, r b) carrying capacity c) density-dependent mortality d) survivorship e) age distribution

Which parameter above would be used to characterize each of the following situations?

9. Barnacles on crowded substrate have a higher probability of been killed than those on new substrate.

10. A few paramecium is added to a beaker with fresh medium and allowed to multiply in optimal conditions.

11. Cockroach population size fluctuates in a traditional market.

12. During the first year of their life, most oyster larvae died, but most mammal infants did not.

13. For the same population size, the Europeans have lower expectation of population size in the future than Central Americans do.

Question 14-17 Refer to the following table concerning photosynthesis in an aquatic plants in a beaker

Light intensity (x 1000 lux)	Bubbles/minute		Ratio Red/Blue
	Red light	Blue light	
120	82	84	1.0
100	83	79	1.1
80	83	70	1.2
40	69	20	3.5
10	17	2	8.5
5	12	0.5	24.0

14. The content of the bubbles is mostly a) air b) O<sub>2</sub> c) CO<sub>2</sub> d) CH<sub>4</sub> e) water

15. The saturation point for photosynthesis in red light is reached at about

a) 120,000 lux b) 120 lux c) 100,000 lux d) 100 lux e) 80,000 lux f) 80 lux

16. If the same apparatus was set up at about 40 m depth in the field, the light intensity was measured at about 10,000 lux, how many bubbles would you expect per minute a) 17 b) 2 c) 83 d) 79 e) 69 f) 20

17. The last column of the table suggests that a) the light meter may require calibration

b) different spectrum of light are absorbed at the same efficiency c) the red light is absorbed at higher efficiency d) the blue light is absorbed at higher efficiency

18. Which of the following statements about meiosis is correct?

- a) Reduction in chromosome number to the haploid set occur at a result of the first division
- b) It may occur after the maturation of eggs and sperm
- c) It may occur in muscle cells and heart cells
- d) crossing-over occurs after the formation of daughter cells
- e) It results in 4 sperm in males, but results in only one egg in females, each event of meiosis

19. Which of the following statements about mitosis is correct?

- a) It does not happen in ovaries or testicles
- b) The daughters can undergo mitosis only
- c) The daughters can undergo meiosis only
- d) The genetic contents of daughter cells are identical
- e) The cytoplasmic contents of daughter cells are identical
- f) all above are correct
- g) none of the above is correct

20. Which of the following is NOT a form of chromosomal aberration or mutation

- a) deletion
- b) duplication
- c) inversion
- d) transcription
- e) translocation

21. A blood sample was collected at a crime scene, but only RNA was successfully analyzed.

Which of the following do you think is most likely to help identifying the suspect?

- a) sequence of t-RNA
- b) sequence of r-RNA
- c) sequence of m-RNA
- d) concentration of t-RNA
- e) concentration of r-RNA
- f) concentration of m-RNA

22. Which of the following is most irrelevant to "genetic fingerprinting"

- a) endonuclease
- b) RFLP
- c) electrophoresis
- d) PPEP
- e) PCR

23. The contents of a cell might change due to environmental conditions. The accumulation of organic acids in the leaves in some plants when there is no light, for example, could lower the pH sufficiently to denature proteins. This acid would be expected to be sequestered in

- a) Golgi apparatus
- b) mitochondria
- c) chloroplast
- d) r-RNA
- e) vacuole

24. At the isoelectric point of a protein, which of the following is expected

- a) pH=7
- b) pH>7
- c) pH<7
- d) density of the protein=1
- e) density of the protein equals that of the medium
- f) none above

25. Which of the following statements is correct about a silent mutation

- a) it won't be passes on to the next generation
- b) it causes ear problem
- c) it is under no selection
- d) it happens on introns only
- e) it just lowers the fitness of the bearer but does not kill the bearer

26. Several observations were made of an organism cultured in a water tank. First, level of dissolved oxygen increased when there is light. Second, live *Artemia*, a small planktonic shrimp, added at regular intervals, disappeared overnight. Which of the following is most likely to be the organism in the tank?

- a) an oyster
- b) a bundle of *Sargassum*
- c) a lobster
- d) a piece of coral
- e) a deep sea isopod

27. Which of the following is a natural taxon

- a. phylum
- b. family
- c. genus
- d. species
- e. all of the above

28. Which of the following contains genetic material

- a. nucleus
- b. plasmid
- c. mitochondria
- d. chloroplast
- e. all above

29. Which of the following groups of chemicals contains more than C, H and O

- 1. polyunsaturated fatty acids
- 2. vitamins
- 3. nucleic acids
- 4. Amino acids
- a. none above
- b. one above
- c. two above
- d. three above
- e. all above

30. Double fertilization occurs in

- a. bilateral animals
- b. flowering plants
- c. bacteria
- d. protozoan
- e. all above

31. Which of the following is NOT involved in TCA cycle

- a. ADP
- b. coenzyme A
- c. cytochrome
- d. FAD
- e. NAD

32. Which one of the following is NOT a plant hormone

- a. auxin
- b. abscisic acids
- c. Gibberellins
- d. ecdysone
- e. cytokinins

33. The following terms: cladistics, phylogeny, are most likely to occur in which chapter of a biology textbook

- a. genetics
- b. nervous system
- c. taxonomy
- d. social biology
- e. embryology

34. Which of the following is NOT correct

- a. Urea is produced in the liver
- b. Urea is concentrated and extracted in the kidney
- c. The duct between kidney and liver is ureter
- d. The bladder stores urine
- e. The urethra is a duct leading from the bladder to the outside

35. How many different genotypes of sperm can a man potentially produce when random assortment is considered? a. 2 b. 23 c. 2<sup>23</sup> d. 23<sup>2</sup> e. 23<sup>23</sup>

36. The enzymes of TCA cycle (citric acid cycle) are found in

- a. ribosome
- b. lysosome
- c. mitochondria
- d. Golgi body
- e. plasma

37. The origin of cells is estimated at about how many years ago?

- a. 35,000,000,000
- b. 3,500,000,000
- c. 350,000,000
- d. 35,000,000
- e. 3,500,000

38. Which is a correct sequence of the following stages, 1: gastrula, 2: morula, 3: zygote,

- 4: blastula
- a) 1234
- b) 4321
- c) 3241
- d) 3412
- e) 2134

39. "9 + 2 arrangement" is a character of

- a) cilia and flagella
- b) DNA and RNA
- c) mitochondria and chloroplast
- d) cell membrane and nuclear membrane
- e) all above

40. C<sub>3</sub> and C<sub>4</sub> pathways differs in

- a) number of neutrons in the atom
- b) number of protons in the atom
- c) number of reactants in the light reaction of photosynthesis
- d) number of C in the primary products of photosynthesis
- e) none of the above

41. "Imprinting" was first discovered in

- a) fruit flies
- b) bacteria
- c) ducks
- d) mouse
- e) frogs

42. The function of antidiuretic hormone is to stimulate

- a) gonad function
- b) reabsorption of water
- c) metabolic rate
- d) immune system
- e) protein synthesis

43. "Punctuated equilibrium" is most likely to be covered in a chapter of  
 a) Evolution      b) Immunology      c) Taxonomy      d) Physiology      e) Histology
44. What is the Period before Jurassic  
 a) Tertiary      b) Cretaceous      c) Triassic      d) Permian      e) Ordovician
45. A single individual produces both eggs and sperm is  
 reproduction      c) hermaphroditism      d) gametogenesis      e) gonochorism
46. "Bottleneck effect" is likely to be discussed in a chapter of  
 a) digestion      b) hormone      c) behavior      d) evolution      e) taxonomy
47. The common function of antennal gland and Malpighian tubules is in  
 a) sensing      b) excretion      c) digestion      d) locomotion      e) reproduction
48. Monoclonal antibody is antibody induced in  
 b) an individual from a single antigen      c) an episode of infection      d) all of the above      e) none of the above
49. Which of the followings are characteristics of Echinoderms  
 1: bilaterally symmetric larvae      2: pentaradially symmetric adults      3: water vascular system in adults  
 a) 1, 3      b) 2, 3      c) 1, 2      d) 1, 2, 3      e) none

Questions 50-54 are based on a protein molecule consisting of 132 amino acids.

50. What is the minimal length of the coding m-RNA  
 e) 792 base pairs      a) 132      b) 264      c) 396      d) 528
51. How many different kinds of t-RNA are necessary when the translation takes place  
 a) 0      b) 3      c) 4      d) 132      e) none of the above
52. One point mutation occurs in the coding gene which transcribes the m-RNA, how many changes in amino acids are expected  
 a) 1      b) 0      c) 0 or 1      d) 132      e) 2
53. One frameshift mutation occurs, how many changes in amino acids are expected  
 a) 0      b) 1      c) 0 or 1      d) 0-132      e) 132
54. How many base pairs are there in the introns  
 a) 132      b) 396      c) 3      d) 4      e) none above

55. The function of restriction enzymes, or endonucleases, is to  
 a) synthesize short strand of peptides inside the nucleus      b) cut DNA into pieces      c) cut proteins into short peptides      d) synthesize short strand      e) all above
56. About DNA which of the following term is correctly interpreted  
 a) semiconservative: identical products only when DNA is used as template to make DNA, not RNA      b) complementary: the sequence of loci are the same in the homologous chromosomes      c) antiparallel: only one centromere for two chromatids before cell division      d) double helix: two homologous chromosomes form two helices, each one is a helix      e) none of the above
57. Choose a correct statement  
 a) all the eggs produced in the life time of a female are the same genetically      b) polar bodies are particular to oogenesis      c) 4 equal-sized daughter cells are produced in oogenesis and spermatogenesis      d) oogenesis and spermatogenesis cannot occur in the same individual      e) none of the above
58. In a study of inheritance, it was found: B is dominant over b whereas incomplete dominance occurs in A and A'. What is the phenotype ratio of matings between BbAA' and bbAA'  
 a) 9:3:3:1      b) 1:2:1      c) 1:3:3:1      d) 1:3      e) 1:2:1:1:2:1
59. In the above question  
 a) the two loci are located in the same chromosome      b) the two loci are located in different chromosomes      c) the four loci are located in the same chromosome      d) the four loci are located in different chromosomes      e) it does not matter

Answer questions 60-68 based on the following abstract: Surveys of the coral-inhabiting snail *Coralliophila violacea* (Lamarck) (= *C. neritoidea* Kiener) were made on shallow fringing reefs (< 8 m deep) around Hsiao-Liuchiu between July and October of 1990. The snails were aggregated into patches on the surface of massive poritid coral colonies. Corals greater than 40 cm in diameter were more likely to have patches of snails than smaller ones, and large colonies tended to have more snails on them. The coralliophilids ranged from 5 to 30 mm in aperture length. The sex-ratio of the population was biased toward males (539:279), with only a few small individuals of indistinguishable sex. Snails between 6 and 10 mm were all males, while most snails with aperture lengths 20 mm or more were females. The snails may have changed sex from male to female with increasing size, judged by the distinct size ranges of males and females within patches as well as by the observed degeneration of the penis. Sex-change may occur across a wide size range (10-20 mm). Our observations indicate that the snail size at sex-change is particular to each patch as suggested by the correlation of the smallest female size and the largest male size among patches. Females in patches with a single female (but many males) were significantly smaller than females in multiple-female patches. It is likely that in the absence of females, males change sex at a smaller size; while in the presence of other large females, snails delay sex-change until reaching a larger

size. The plasticity of size at sex-change may be adaptive and a result of natural selection at individual level.

60. A most proper title of the above is a) Distribution of corals b) Competition between corals c) Competition between corals and snails d) Distribution of snails e) Sex-change of a coral d) Sex-change of a coral-inhabiting snail

61. What method is used in collection of samples a) bought from the market b) museum collections c) fossil record d) surveyed from existing literature e) by diving

62. What is the approximate size of the snail? a) 8 m b) 40 cm c) 5-30 mm d) information not available

63. The snail is a) protandrous b) protogynous c) iteroparous d) simultaneous hermaphrodites e) all above f) none above

64. The relationship between the snail and the coral is an example of a) prey-predator b) predator-prey c) competition d) symbiotism e) parasitism f) sexual selection

65. The above abstract is excerpted from "Mar. Biol. 111:81-86". What information is contained between the quotation marks a) Field, pages, period b) Journal, volume, pages c) Location, pages, samples d) Textbook, edition, pages e) none above

66. From the information between the quotation marks in the above question, one can a) understand how much work is involved b) estimate the cost of the study c) evaluate data reliability d) find the original and full content of the paper e) Call the book dealer and find the textbook

67. In line two, Lamarck and Kiener each appears after scientific names, these people's names are there because a) they are experts in snails b) they are experts in taxonomy c) they are the persons first described the respective genera d) they are the persons first described the respective species e) the species were named after them

68. It is implied from the abstract that a) the author is a man b) the author is a woman c) the author changed sex from male to female d) there are more than one author

69. The chemical structure of a steroid contains a) 1 b) 2 c) 3 d) 4 e) 5 interconnecting rings.

70. Which of the following is NOT considered a steroid a) cholesterol b) cortisol c) carotenoid d) male hormone e) female hormone

71. Rank the following according to their sizes: mitochondria, nucleus, t-RNA, ribosome a) m>n>t>r b) n>m>t>r c) m>n>r>t d) n>m>t>r e) r>m>n>t f) r>n>m>t

Questions 72-76. What phylum does each organism belongs a) Coelenterata b) Arthropoda c) Mollusca d) Annelida e) Echinodermata f) Chordata

72. Barnacles

73. Squids

74. Sea cucumbers

75. Giant clams

76. Jellyfishes

77. When the first 4 blastomeres of a sea urchin embryo are separated and then allowed to develop while isolated from one another a) 4 abnormal embryos develop b) 4 normal but small embryos develop c) two normal and two abnormal embryos develop d) they all cease to develop

79. Which of the following is true of a plant with clear generation alteration a) The sporophyte produces the zygote b) The gametophyte produces the spores c) The zygote develops into the gametophyte d) The gametes are produced by mitosis e) The spores develop into sporophytes

80. A DNA sequence that is homologous to a functional gene in the same genome, but is itself nonfunctional is a) pseudogene b) oncogene c) primer d) polygene e) intron

甲. 填充題 (每點2分) (50%)

1. 除了人工魚礁外,栽培漁業尚有其它工作項目,主要如:(1) \_\_\_\_\_ ;  
(2) \_\_\_\_\_ ;(3) \_\_\_\_\_ .
2. 除了漁具漁法外,水產生物學尚包含其它內容,主要如:(4) \_\_\_\_\_ ;  
(5) \_\_\_\_\_ ;(6) \_\_\_\_\_ ;(7) \_\_\_\_\_ .
3. 台灣目前海水箱網養殖的主要魚類包括:(8) \_\_\_\_\_ ;  
(9) \_\_\_\_\_ ;(10) \_\_\_\_\_ .
4. 台灣目前出版之有關水產生物科學的主要中文刊物包括:  
(11) \_\_\_\_\_ ;(12) \_\_\_\_\_ ,英文刊物包括:  
(13) \_\_\_\_\_ 和 (14) \_\_\_\_\_ 幾種。
5. 體型長大至可被網具捕撈時的魚群就稱為進入了(15) \_\_\_\_\_ 。
6. 單位努力漁獲量的簡稱為(16) \_\_\_\_\_ ,可以有各種不同的表示單位,例如:(17) \_\_\_\_\_ ;(18) \_\_\_\_\_ ;和  
(19) \_\_\_\_\_ 。
7. 標識放流可有各種不同的目的,包括:(20) \_\_\_\_\_ ;  
(21) \_\_\_\_\_ ;  
(22) \_\_\_\_\_ .
8. 針對底棲性魚類而使用的主要漁具有:(23) \_\_\_\_\_ ;  
(24) \_\_\_\_\_ 和 (25) \_\_\_\_\_ 等。

乙. 問答計算題

1. 請說明水產軟體動物的生物特性。(15%)
2. 何謂聖嬰流(El Nino)? 與漁業有何重要之關聯? (15%)
3. 假設某魚群的瞬間(年)自然死亡率係數每年均為 $M=0.2000$ ,三歲起成為漁獲作業對象,其瞬間(年)漁獲死亡率係數為 $F=0.1850$ 。若該魚群某年級群在零歲時的總數量為10,000尾,請推算該年級群在剛滿六歲時的數量應為若干? (請以算式寫出各推算步驟)

(20%)

I. Multiple choice (only one correct answer in each question). (20%)

1. The allele frequency of a population is 0.2 p and 0.8 q, what is the genotypic frequency of heterozygotes in the F1 generation?  
(a) 0.2 (b) 0.8 (c) 0.32 (d) 0.16 (e) 1.
2. Which one is wrong? The greenhouse effect is formed by (a) long-wave solar radiation enters the Earth (b) Earth's atmosphere reradiated back long-wave radiation (c) carbon dioxide retains much of the reradiated heat on the Earth (e) human activities.
3. Kuroshio Current passes which part of Taiwan (a) West (b) North (c) South (d) East (e) Southwest.
4. Human beings are (a) monoecious (b) hermaphroditic (c) semelparity (d) r-selected (e) iteroparity.
5. Fitness of one species increases and the other remains neutral is called (a) mutualism (b) amensalism (c) predation (d) commensalism (e) parasitism.
6. Conserving threatened species can be managed through (a) habitat restoration (b) captive breeding (c) protection and education (d) population control (e) all of the above.
7. Which habitat has the greatest diversity? (a) sand beach (b) coral reef (c) deep sea (d) hydrothermal vent (e) none of the above.
8. Thermocline usually occurs (a) in early winter (b) in tropical area (c) with hypoxia on the bottom (d) with low nutrients on the bottom (e) none of the above.
9. Which one is not a common organism on a sand beach? (a) clam (b) sand dollar (c) amphipod (d) barnacle (e) worm.
10. BOD is (a) a measure of the oxygen needed of water (b) the need to form organic materials (c) called as biophysical oxygen demand (d) an index to measure conductivity (e) none of the above.

II. Explain the following terms. (30%)

1. Phenotypic plasticity
2. Sustained yield
3. Shannon index
4. Secondary succession
5. Zooxanthellae
6. Biological magnification
7. Catadromous fish

8. Keystone species

9. Inbreeding

10. Turnover rate

11. Carnivore

12. Coriolis effect

13. Epifauna

14. Bottleneck

15. Natural selection

III. Assay questions (50%)

1. Describe the seashore of Taiwan.

2. How does habitat fragmentation, destruction, and deterioration relate to viable population size and extinction?

3. What is a trophic level? relate the levels to ecological pyramids.

4. How could you argue for preservation of wetlands on an economic basis to developers and local governments?

5. What is upwelling? What is its ecological importance? Is there any upwelling around Taiwan?

一、解釋名詞：

1. protoplast (2%)
2. thallus (2%)
3. water potential (4%)
4. Bryophyta (2%)
5. Tracheophyta (2%)
6. pollination (4%)
7. specific growth rate (2%)
8. plant hormone (4%)
9. phytochrome (4%)
10. stress (4%)

二、簡答題：

1. Illustrate the electron transport and carbon fixation in photosynthesis. (20%)
2. Which processes in plant development and growth are regulated by light? (20%)
3. Illustrate the alternation of generation in *Ulva* sp. (a green macroalga) (10%)
4. What is "plant succession and evolution"? (10%)
5. Describe the Mendelian characters and tissue culture-derived genetic mutation (10%)



壹、選擇題(每題有一個或多個答案，每題 2 分)

1. The major characteristic of a negative-feedback system is that
  - (a) it tends to push a variable towards the operating point
  - (b) it tends to push a variable away from the operating point
  - (c) it eliminates completely any change from the operating point
  - (d) it leads to stability
  
2. Excitable membranes
  - (a) are present on all membrane-bound tissues
  - (b) are responsible for the cell's ability to produce action potentials
  - (c) require myelin to act as an insulator for electrical events
  - (d) can experience a reversal of the electric potential across the membrane
  
3. Which of the following are involved in the integrator function of nerve cells?
  - (a) facilitation
  - (b) temporal summation
  - (c) spatial summation
  - (d) convergence
  
4. Which of the following hormones are secreted from the adrenal cortex?
  - (a) cortisol
  - (b) oxytocin
  - (c) epinephrine
  - (d) aldosterone
  
5. Following the surgical removal of the anterior pituitary
  - (a) blood concentration of ACTH would rise
  - (b) the hypothalamo-pituitary portal vessel concentration of CRH would rise
  - (c) blood concentration of somatomedin would fall
  - (d) blood concentration of cortisol would fall
  
6. Which of the following bind to calcium may activate muscle contraction?
  - (a) troponin
  - (b) tropomyosin
  - (c) actin
  - (d) myosin

7. Which of the following has been identified as the major variable contributing to the ventilation changes during exercise?

- (a)  $P_{CO_2}$
- (b)  $P_{O_2}$
- (c)  $H^+$  concentration
- (d) none of the above

8. Inputs that may increase renin release include:

- (a) increased plasma volume
- (b) decreased activity of renal sympathetic nerves
- (c) decreased renal arterial blood pressure
- (d) increased plasma levels of aldosterone

9. Increased activity of the sympathetic nervous system

- (a) raises the plasma concentration of epinephrine
- (b) results in glycogenolysis
- (c) results in increased fat storage
- (d) stimulates insulin secretion

10. Inflammation

- (a) produces red blood cell
- (b) occurs in response to an injury
- (c) results in a decrease in blood flow to the inflamed area
- (d) results in a decrease in the capillary permeability in the inflamed area

貳、解釋名詞 (每題 4 分)

- 1. acclimatization
- 2. calmodulin
- 3. dark current
- 4. receptor
- 5. gap junction
- 6. serum
- 7. inhibin
- 8. tidal volume
- 9. allergy
- 10. presynaptic inhibition

(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：動物生理學 (海生所選考)

共 3 頁 第 3 頁

參、問答題 (每題 8 分)

1. List the sequence of events in the cAMP second messenger system.
2. Describe the magnitude and direction of the changes in sodium and potassium permeability during the different phases of the action potential.
3. Describe the role of gonadotropin-releasing hormone and the pituitary gonadotropin in gametogenesis and steroidogenesis.
4. Contrast cell-mediated immunity with humoral immunity in terms of amplification process.
5. State the two processes that define the amount of sodium excreted.

5

5

10

10

15

15

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25

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30