

國立中山大學 103 學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【海資系碩士班甲組】

題號：452003

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Part I. 單選題(每題2分，不倒扣)

- 1) Once transcribed, eukaryotic mRNA typically undergoes substantial alteration that includes
A) fusion with other newly transcribed mRNA. B) excision of introns. C) fusion into circular forms known as plasmids. D) linkage to histone molecules. E) union with ribosomes.
- 2) Adult lampreys attach onto large fish and feed regularly on their body fluids. Given this continuous supply of food, which one of the following is *most* likely missing in lampreys?
A) stomach B) pancreas C) gallbladder D) liver E) intestine
- 3) How does an EPSP facilitate depolarization of the postsynaptic membrane?
A) by increasing the permeability of the membrane to K^+ B) by increasing the permeability of the membrane to Na^+ C) by stimulating the sodium-potassium pump D) by allowing Cl^- to enter the cell E) by insulating the hillock region of the axon
- 4) The star of a recent movie was a caterpillar that never matured into an adult. It simply got larger with each molt. What is the probable reason why the caterpillar did not mature into an adult?
A) increased level of juvenile hormone B) lack of ecdysone C) lack of juvenile hormone D) lack of the melatonin hormone E) decreased level of ecdysone
- 5) What is considered to be the first evidence of differentiation in the cells of an embryo?
A) changes resulting from induction B) changes in the size and shape of the cell C) the occurrence of mRNAs for the production of tissue-specific proteins D) cell division E) determination
- 6) What is a hypothesis?
A) a tentative explanation that can be tested and is falsifiable B) the same thing as an unproven theory C) a verifiable observation sensed directly, or sensed indirectly with the aid of scientific instrumentation D) a fact based on qualitative data that is testable E) a fact based on quantitative data that is falsifiable
- 7) A person with a tidal volume of 450 mL, a vital capacity of 4,000 mL, and a residual volume of 1,000 mL would have a potential total lung capacity of
A) 4,000 mL. B) 1,450 mL. C) 5,450 mL. D) 5,000 mL. E) 4,450 mL.
- 8) What is the role of calcium in muscle contractions?
A) spread the action potential through the T tubules B) bind to the troponin complex, which leads to the exposure of the myosin-binding sites C) break the cross-bridges as a cofactor in the hydrolysis of ATP D) transmit the action potential across the neuromuscular junction E) reestablish the polarization of the plasma membrane following an action potential
- 9) After ovulation, high levels of _____ inhibit _____ secretion.
A) HCG; estrogen and progesterone B) androgens; FSH and LH C) FSH and LH; estrogen and progesterone D) estrogen and progesterone; FSH and LH E) estrogen; FSH
- 10) Pyruvate is formed
A) in the nucleus. B) on the outer mitochondrial membrane. C) on the inner mitochondrial membrane. D) in the cytosol. E) in the mitochondrial matrix.
- 11) What name is given to organisms that convert the carbon in organic compounds into carbon in carbon dioxide?
A) heterotrophs B) autotrophs C) decomposers D) plants E) recyclers

背面有題

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12) When a potassium ion (K^+) moves from the soil into the vacuole of a cell on the surface of a root, it must pass through several cellular structures. Which of the following correctly describes the order in which these structures will be encountered by the ion?

- A) secondary cell wall → plasma membrane → primary cell wall → cytoplasm → tonoplast
- B) primary cell wall → plasma membrane → cytoplasm → tonoplast
- C) tonoplast → primary cell wall → plasma membrane → cytoplasm
- D) primary cell wall → plasma membrane → tonoplast → cytoplasm → vacuole
- E) plasma membrane → primary cell wall → cytoplasm → tonoplast

For the following questions, match the key event of meiosis with the stages listed below.

- | | |
|-----------------|--------------------|
| I. prophase I | V. prophase II |
| II. metaphase I | VI. metaphase II |
| III. anaphase I | VII. anaphase II |
| IV. telophase I | VIII. telophase II |

13) Centromeres of sister chromatids uncouple and chromatids separate.

- A) II B) III C) IV D) V E) VII

14) Which structure is the site of the synthesis of proteins that may be exported from the cell?

- A) rough ER B) lysosomes C) plasmodesmata D) tight junctions E) Golgi vesicles

15) RFLPs played an important role in the Human Genome Project because they

- A) dramatically enhance the rate at which DNA can be sequenced. B) increase the amount of DNA that can be produced during PCR. C) provided genetic markers scattered throughout the genome, allowing the construction of a genome-wide linkage map. D) do not vary between individuals, so they were used to produce a "universal" genome sequence representative of all humans. E) make bacterial cells grow faster, increasing the amount of cloned DNA that was available for sequencing.

16) Which of the following is *least* related to the others?

- A) tumor suppression B) cyclins C) ubiquitin D) proteasomes E) protein degradation

17) Which of the following is analogous to telomeres?

- A) the pull tab on a soft drink can B) the correct letters used to replace errors in a document after they have been deleted in a word processor C) the two ends of a shoelace D) the mechanism of a zipper that allows the separated parts to be joined E) the central spindle that a CD fits around while in the case

18) Testosterone functions inside a cell by

- A) binding with a receptor protein that enters the nucleus and activates specific genes. B) becoming a second messenger that inhibits adenylyl cyclase. C) coordinating a phosphorylation cascade that increases glycogen metabolism. D) acting as a signal receptor that activates ion-channel proteins. E) acting as a steroid signal receptor that activates ion-channel proteins.

19) Which of the following characterizes the sodium-potassium pump?

- A) Potassium ions are pumped into a cell against their gradient. B) The pump protein undergoes a conformational change. C) Sodium ions are pumped out of a cell against their gradient. D) Only A and B are correct. E) A, B, and C are all correct.

20) Which of the following are *not* associated with sponges?

- A) amoebocytes B) cnidocytes C) oscula D) spicules E) spongocoels

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- 21) Density-dependent inhibition is explained by which of the following?
A) As cells become more numerous, more and more of them enter the S phase of the cell cycle.
B) As cells become more numerous, the protein kinases they produce begin to compete with each other, such that the proteins produced by one cell essentially cancel those produced by its neighbor.
C) As cells become more numerous, the amount of required growth factors and nutrients per cell becomes insufficient to allow for cell growth.
D) As cells become more numerous, the level of waste products increases, eventually slowing down metabolism.
E) As cells become more numerous, they begin to squeeze against each other, restricting their size and ability to produce control factors.
- 22) Which process could be compared to how rushing steam turns a water wheel?
A) formation of NADH in glycolysis B) the electron transport system C) the citric acid cycle D) oxidative phosphorylation E) ATP synthase activity
- 23) In the early development of an amphibian embryo, an important "organizer" is located in the
A) notochord. B) neural tube. C) dorsal lip of the blastopore. D) archenteron roof. E) dorsal ectoderm.
- 24) Which of the following statements is *correct* about diffusion?
A) It is an active process in which molecules move from a region of lower concentration to one of higher concentration. B) It requires an expenditure of energy by the cell. C) It requires integral proteins in the cell membrane. D) It is very rapid over long distances. E) It is a passive process in which molecules move from a region of higher concentration to a region of lower concentration.
- 25) Most signal molecules
A) bind to specific sites on receptor proteins in a membrane. B) are water-soluble. C) are able to pass through the plasma membrane by active transport. D) A and B only E) A, B, and C
- 26) Regarding mitosis and cytokinesis, one difference between higher plants and animals is that in plants
A) sister chromatids are identical, but they differ from one another in animals.
B) the spindles contain microfibrils in addition to microtubules, whereas animal spindles do not contain microfibrils.
C) a cell plate begins to form at telophase, whereas animals a cleavage furrow is initiated at that stage.
D) chromosomes become attached to the spindle at prophase, whereas in animals chromosomes do not become attached until anaphase.
E) spindle poles contain centrioles, whereas spindle poles in animals do not.
- 27) Viral genomes can consist of any of the following *except*
A) single-stranded RNA. B) double-stranded RNA. C) single-stranded DNA. D) helical capsomeres.
E) double-stranded DNA.
- 28) In the inflammatory response, the absence of which of the following would prevent all the others from happening?
A) increased permeability of blood vessels B) increased population of phagocytes in the area C) leakage of plasma to the affected area D) dilation of arterioles E) release of histamine
- 29) In animals, meiosis results in gametes, and fertilization results in
A) sporophytes. B) spores. C) gametophytes. D) zygotes. E) clones.

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30) Glucose is removed from filtrate by

A) diffusion. B) dialysis. C) osmosis. D) secretion. E) active transport.

Part II. 解釋名詞(每題4分)

1. Desmosome
2. Epitope
3. Exon
4. Hybridoma
5. Notochord
6. Okazaki fragment
7. Taxonomy
8. Capsid
9. Biomass
10. Phylum Echinodermata

國立中山大學 103 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海資系碩士班乙組】

題號：452002

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(I) Reading Comprehension 閱讀能力測驗 (40%)

請閱讀以下短文，並用英文回答問題第 1~4 小題，每小題 10 分。

“Most substances that enter the oceans ultimately end up in the sediments. On the way, they participate in a variety of complex biological and chemical cycles and interactions which involve some substances more than others. Interactions continue after deposition: sediments do not lie passively on the sea-bed until they are buried. Deep-sea animals disturb the sediments as they forage for food, and some sediment may experience erosion and resuspension by bottom currents before being redeposited and finally buried. Chemical reactions may occur between the mineral grains and the overlying seawater, and these reactions can continue after burial, when seawater becomes trapped among the grains.

“Nowadays, deep-sea sediments are a focus of much research effort, because of the growing need to quantify the various fluxes contributing to the global carbon cycle. A principal aim is to find out just what happens to the anthropogenic carbon dioxide and other gases contributing to the greenhouse effect, which may already have begun to lead to global atmospheric warming. If the present trend continues, major climatic changes and rising sea-levels will result. To predict the extent of such changes successfully, it is essential to know more about rates of increase of greenhouse gases in the atmosphere. This in turn requires improved knowledge of, for example, seasonal, inter-annual and regional fluctuations in ocean surface productivity, the removal of organic matter to the sea-bed, exchanges across the air-sea interface, and vertical and horizontal water movements. International and national programs initiated to investigate these and related problems include the Joint Global Ocean Flux Study (JGOFS), the Biogeochemical Ocean Flux Study (BOFS), and the somewhat broader World Ocean Circulation Experiment (WOCE).

“Nor should the seawater itself be forgotten. The dissolved constituents of seawater include metals such as copper, lead, zinc, tin, manganese, cadmium, mercury, nickel and silver. Geochemical cycles of these and other heavy metals are being grossly perturbed by human activity. Inputs have increased substantially since the Industrial Revolution, although only in the case of lead has the average concentration in open ocean waters actually increased, as a result of atmospheric fall-out. In addition, there are many new substances in the marine environment that were not there even a century ago. These include pesticides and other organic chemicals, as well as transuranic and other 'man-made' nuclides from nuclear weapons testing and low-level waste discharges. Global flux studies will contribute greatly to our understanding of how the many constituents of seawater—both dissolved and particulate, both natural and artificial—move through the various marine chemical cycles. But we begin by looking at the sediments.”

[Quoted from: The Open University Course Team, 1989, *Ocean Chemistry and Deep-Sea Sediments*. Open University/Pergamon Press, 134 p.]

Please answer the following questions in English:

1. What might the deep-sea sediments experience before and after they are deeply buried? (10%)
2. What causes global atmospheric warming? How will the global warming trend affect our lives? (10%)
3. Scientists study seasonal, inter-annual and regional fluctuations in ocean surface productivity. What are these studies related to the global warming? (10%)
4. According to this short article and your knowledge, what processes and sources might have caused the increase of lead concentration in open ocean water since the Industrial Revolution? (10%)

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(II) Translate the following two paragraphs into Chinese 英翻中測驗 (40%)

1. “Hydrothermal vent communities characterized by large clams, mussels, and vestimentiferan worms thrive on chemosynthetic microbial production. There are similarities in the animal distributions at vent communities from 20°S to 46°N on the Mid-Ocean Ridge in the Pacific Ocean and at cold sulfide seeps in the Gulf of Mexico. Vent communities, consisting of at least 16 previously unknown families of invertebrates, are at least 200 million years old. Since the life-span of a vent is only tens of years, the species survive by rapid growth and widespread dispersal of larvae with the subsequent colonization of new vents.” [Quoted from: Grassle, J. F., 1985, *Science*, vol. 229, 713–717.] (20%)
2. “For 3 decades, geologists have been pushing the operation of plate tectonics farther and farther back into Earth's history. And the push continues. At first, scientists proposed a few hundred million years ago as the earliest time when plates roamed, mid-ocean ridges churned out new crust, and old crust sank into the deep earth. But once they knew what to look for, they began finding older and older rocks that bear the marks of plate tectonics. Now, a new discovery, announced at the meeting, appears to push plate tectonics back another half-billion years or more to 2.7 billion years ago. That puts plate tectonics firmly in the Archean eon, when the planet had seemed to work differently than it does today.” [Quoted from: Kerr, R. A., 2000, *Science*, vol. 290, 2239–2242.] (20%)

(III) Translate the following paragraph into English 中翻英測驗 (20%)

1. 一個科學學說（或稱理論）的成立必須經由科學方法的許多步驟來達成，科學方法是植基於我們相信宇宙萬物是有規律的運行著，因此透由客觀地分析我們所觀察到的現象或事實資料，我們能夠找出各種事物或現象的運作方式與機制。以下舉出科學方法常用的幾個步驟：
（1）提出問題或疑難—要有好奇心；（2）蒐集相關的資料或事實，並加以分析和解讀；
（3）提出能夠合理解釋該問題或所觀察事實的假說；（4）驗證所提出的假說—透由進一步的實驗設計與觀察結果來驗證假說；（5）通過反覆驗證而且能預測觀察結果的假說即成為一個學說或理論。(20%)

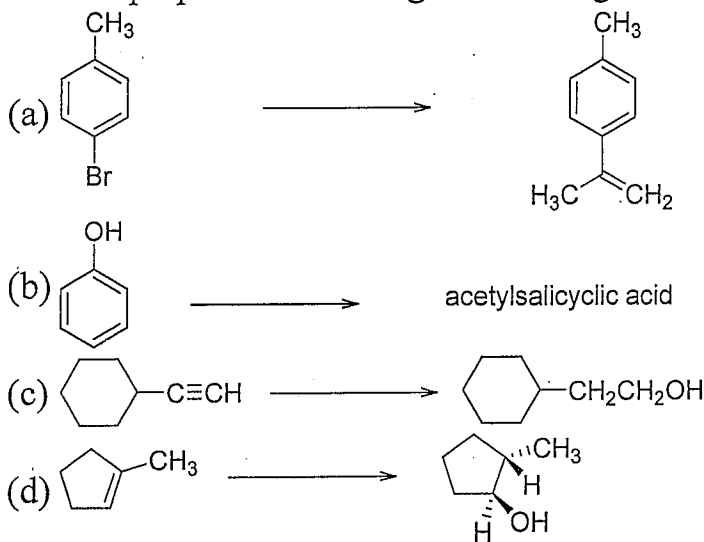
1. Draw structures for the following compounds. (3% each)

- Bromomethylbenzene
- 1-isopropyl-2-methyl-cyclopentene
- (1*R*,3*S*)-1,3-cyclopentanediol
- 2-chlorotoluene
- sec*-butylisobutylacetylene
- 6-bromo-2,3-dimethyl-2-hexene

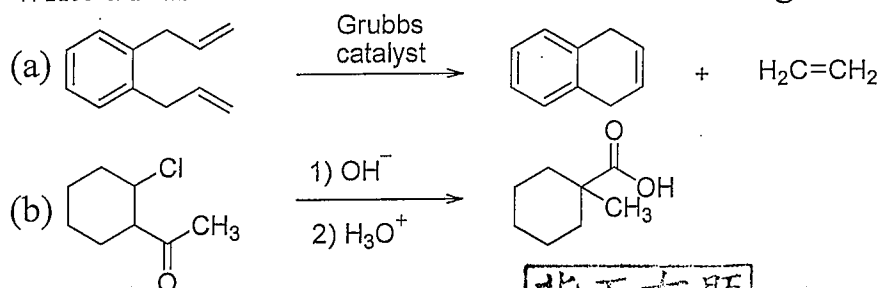
2. Explain the following terms (3% each)

- Michael reaction
- Friedel-Crafts acylation
- Vicinal coupling
- McLafferty rearrangement
- Diamagnetic anisotropy

3. For each of the following target molecules, design a multistep synthesis to show how it could be prepared from the given starting material: (3% each)



4. Write a reasonable mechanism for each of following transformation. (3% each)



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科目名稱：有機化學【海資系碩士班丙組】

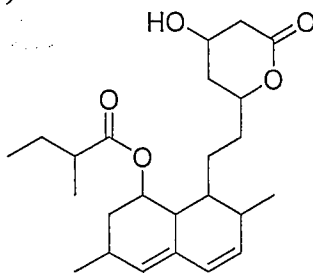
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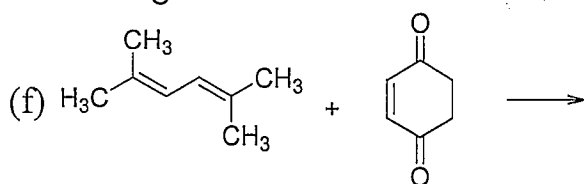
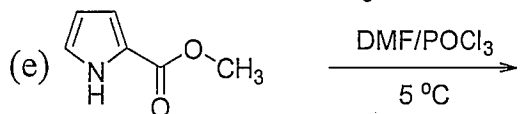
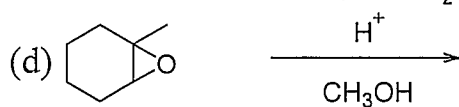
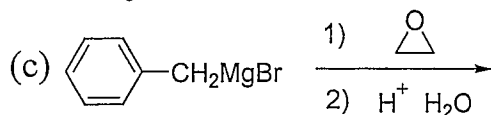
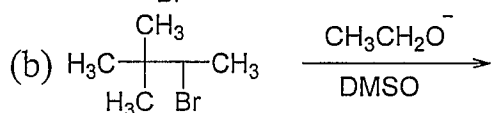
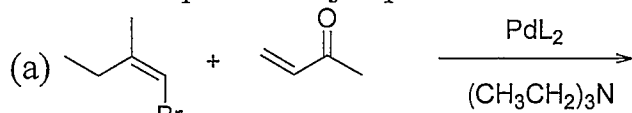
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5. Which of the following compounds has a stereoisomer that is a meso compound? (3%)
 a) 2,4-dibromohexane, b) 2,4-dibromopentane, c) 3,4-diethylhexane
 d) 1,2-dichlorocyclohexane, e) 1,3-dichlorocyclohexane, f) 1,4-dichlorocyclohexane

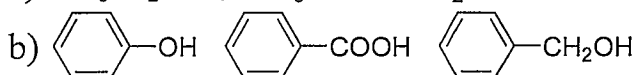
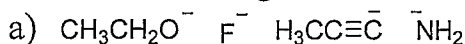
6. Mevacor is used clinically to lower serum cholesterol levels. How many asymmetric centers does Mevacor have? (4%)



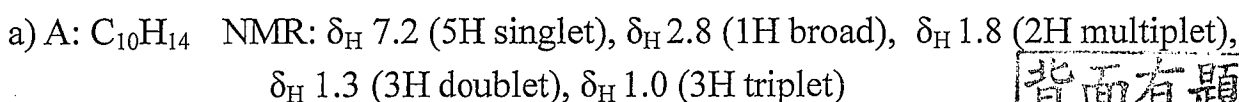
7. Give the expected major product for the following reactions. (3% each)



8. List the following in order of decreasing basicity (a) and acid strength (b): (4%)



9. Deduce the structures of compounds A and B from the data. (5% each)

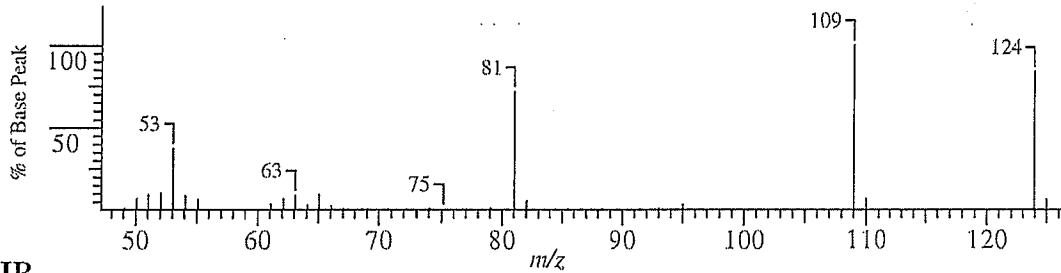


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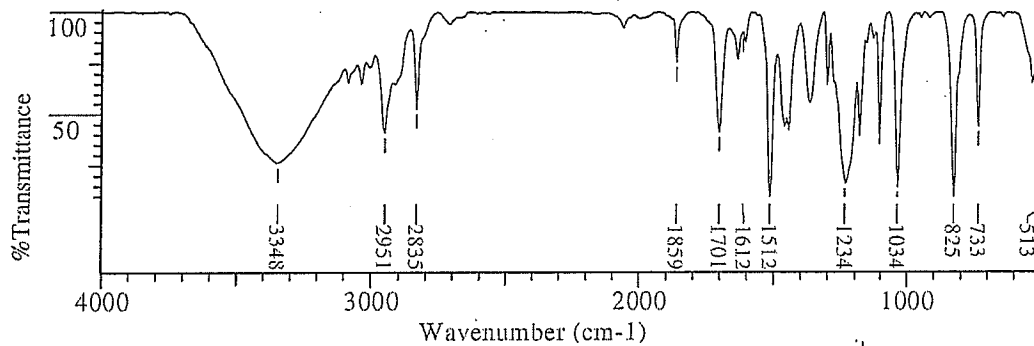
b)B: $C_{15}H_{14}O$ NMR: δ_H 7.25 (10H multiplet), δ_H 5.06 (1H singlet), δ_H 2.20 (3H singlet); IR spectrum: a strong peak near 1720 cm^{-1}

10. Determine the structure of the compound whose molecular formula is $C_7H_8O_2$ for which the mass, IR, 1H NMR, and ^{13}C /DEPT NMR spectra are given. (10%)

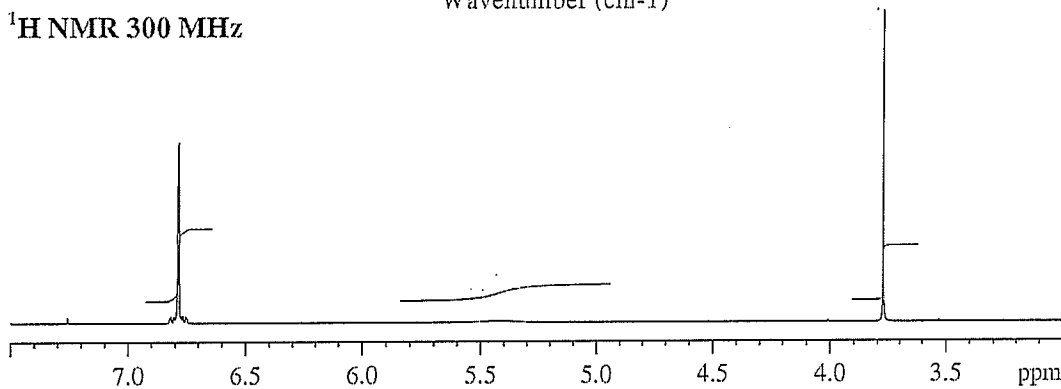
MASS



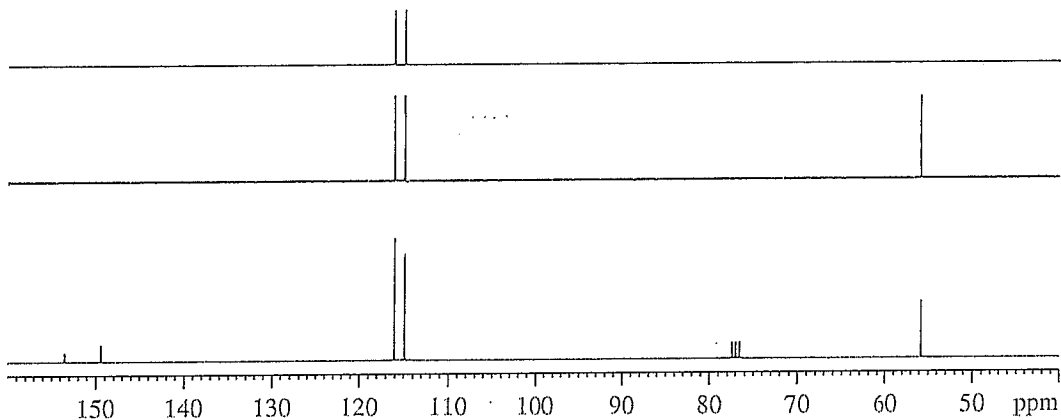
IR



1H NMR 300 MHz



^{13}C /DEPT NMR 75.5 MHz



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科目名稱：生物化學【海資系碩士班甲組選考】

題號：452006

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Part I. 簡答題 (each 10%)

1. 簡述當 DNA 受損時細胞內有何機轉可以進行修復?
2. 請設計一個實驗流程來取得細胞膜上的蛋白質。
3. 何謂是 protein domain 及 protein motif? 兩者最大的差別為何?
4. Stereochemistry 對於生物體及藥物化學有何重要性?
5. 細胞內的 pyruvate 如何產生能量? 請包含反應的 enzyme 及中間化謝物。
6. NADA 及 NADPH 在生物體上扮演什麼功能?

Part II. 解釋名詞 (each 4%)

1. Post-translational modification, PTM
2. Western blot
3. Lipid raft
4. TATA box
5. RNA Interference
6. Isoelectric focusing
7. Enzyme-linked immunosorbent assay
8. Glycogenesis
9. Ames test
10. Oxidative Phosphorylation

國立中山大學 103 學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【海資系碩士班乙組選考】

題號：452007

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Part I. 單選題(每題2分，不倒扣)

- 1) _____ is composed of DNA and protein.
A) A mitochondrion B) A flagellum C) A ribosome D) A centriole E) Chromatin
- 2) What property of water is responsible for water transport in plants?
A) cohesion B) its role as a buffer C) its versatility as a solvent D) insulation E) moderation of temperature
- 3) Where would an ecologist find the most phytoplankton in a lake?
A) photic zone B) aphotic zone C) profundal zone D) oligotrophic zone E) benthic zone
- 4) One liter of a solution of pH 2 has how many more hydrogen ions (H^+) than 1 L of a solution of pH 6?
A) 10,000 times more B) 100,000 times more C) 4 times more D) 4,000 times more E) 400 times more
- 5) The central concept of sociobiology is that
A) the behavior of an individual cannot be modified. B) human behavior is rigidly predetermined. C) most aspects of our social behavior have an evolutionary basis. D) our behavior consists mainly of fixed action patterns. E) the social behavior of humans is homologous to the social behavior of honeybees.
- 6) Which of these ecosystems accounts for the largest amount of Earth's net primary productivity?
A) savanna B) open ocean C) salt marsh D) tropical rain forest E) tundra
- 7) In models of sigmoidal (logistic) population growth,
A) new individuals are added to the population most rapidly at intermediate population sizes. B) density-dependent factors affect the rate of population growth. C) population growth rate slows dramatically as N approaches K . D) All of the above are true. E) Only A and C are true.
- 8) Which of the following would be most likely to exhibit uniform dispersion?
A) cattails, which grow primarily at edges of lakes and streams B) dwarf mistletoes, which parasitize particular species of forest trees C) tassel-eared squirrels, which are nonterritorial D) red squirrels, which hide food and actively defend territories E) lake trout, which seek out deep water
- 9) What important criterion was used in the late 1960s to distinguish between the three multicellular eukaryotic kingdoms of the five-kingdom classification system?
A) the number of cells present in individual organisms B) the nutritional modes they employ C) the geological stratum in which fossils first appear D) the features of their embryos E) the biogeographic province where each first appears
- 10) The success with which plants extend their range northward following glacial retreat is best determined by
A) whether there is simultaneous migration of herbivores. B) their size. C) their seed dispersal rate. D) their growth rate. E) their tolerance to shade.
- 11) Although absolute distinctions between the "most evolved" protobiont and the first living cell are unclear, biologists generally agree that one major difference is that protobionts could *not*
A) grow in size. B) perform osmosis. C) possess a selectively permeable membrane boundary. D) absorb compounds from the external environment. E) perform controlled, precise reproduction.
- 12) Amino acids are acids because they always possess which functional group?

背面有題

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科目名稱：普通生物學【海資系碩士班乙組選考】

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A) amino B) aldehyde C) carbonyl D) sulfhydryl E) carboxyl

13) Water's surface tension and heat storage capacity is accounted for by its

A) orbitals. B) weight. C) mass. D) size. E) hydrogen bonds.

14) Modern conservation science increasingly aims at

A) maintaining all genetic diversity within all species. B) sustaining biodiversity of entire ecosystems and communities. C) protecting federally listed endangered species. D) lobbying for strict enforcement of the U.S. Endangered Species Act. E) both A and B

15) What was the species concept used by Linnaeus?

A) phylogenetic B) ecological C) biological D) morphological E) paleontological

16) Which action could produce a carbonyl group?

A) the replacement of the hydroxyl of a carboxyl group with hydrogen B) the addition of a thiol to a hydroxyl C) the addition of a sulfhydryl to a carboxyl D) the replacement of the nitrogen of an amine with oxygen E) the addition of a hydroxyl to a phosphate

17) Which of the following terms best describes the interaction between termites and the protozoans that feed in their gut?

A) endoparasitism B) mutualism C) commensalism D) ectoparasitism E) competitive exclusion

18) In a Hardy-Weinberg population with two alleles, A and a , that are in equilibrium, the frequency of allele a is 0.2. What is the frequency of individuals with Aa genotype?

A) 0.42 B) 0.20 C) 0.80 D) 0.32 E) Genotype frequency cannot be determined from the information provided.

19) Forest fragmentation is likely to result in

A) a loss of species that live in open habitat. B) an increase in species that live in open habitat. C) a loss of species that live in the interior of forests. D) B and C only E) A, B, and C

20) Which of the following statements about community interactions is *not* correct?

A) Some predators use mimicry to attract prey. B) Mutualism is an important biotic interaction that occurs in communities. C) Closely related species may be able to coexist if there is at least one significant difference in their niches. D) Keystone predators reduce diversity in a community by holding down or wiping out prey populations. E) Plants can defend themselves against herbivores by the production of compounds that are irritating or toxic.

Refer to Figure 1, a diagram of a food web, for the following questions.
(Arrows represent energy flow and letters represent species.)

21) If this were a terrestrial food web, the combined biomass of C + D would probably be

A) greater than the biomass of B. B) greater than the biomass of A. C) less than the biomass of E. D) less than the biomass of A + B. E) less than the biomass of H.

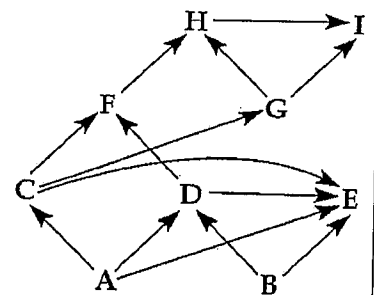


Figure 1

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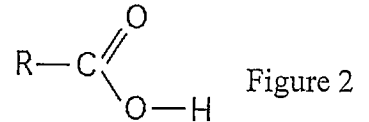
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22) What limits the resolving power of a light microscope?

A) the type of lens that focuses a beam of electrons through the specimen B) the type of heavy metal or dye that is used to stain the specimen C) the ratio of an object's image to its real size D) the type of lens used to magnify the object under study E) the shortest wavelength of light used to illuminate the specimen

23) What is the name of the functional group shown in Figure 2?

A) hydroxyl B) carboxyl C) ketone D) aldehyde E) carbonyl



24) The formation of ice during colder weather helps moderate the seasonal transition to winter. This is mainly because

A) ice is denser than liquid water. B) the formation of hydrogen bonds absorbs heat. C) the formation of hydrogen bonds releases heat. D) the breaking of hydrogen bonds absorbs heat. E) there is greater evaporative cooling of lakes.

25) Which of the following statements about species, as defined by the biological species concept, is (are) correct?

- I. Biological species are defined by reproductive isolation.
- II. Biological species are the model used for grouping extinct forms of life.
- III. The biological species is the largest unit of population in which successful reproduction is possible.

A) I, II, and III B) I only C) II only D) II and III E) I and III

26) Which of the following might affect the foraging behavior of an animal in the context of optimal foraging?

A) prey size B) prey defenses C) risk of predation D) A and B only E) A, B, and C

27) Generally, within a lineage, the largest number of shared derived characters should be found among two organisms that are members of the same

A) order. B) family. C) class. D) domain. E) kingdom.

28) Which of these structures is unique to plant cells?

A) mitochondrion B) flagellum C) central vacuole D) peroxisome E) nucleoid region

29) Adult male vervet monkeys have red penises and blue scrotums. Males use their colorful genitalia in dominance displays wherein they compete with each other for access to females. The coloration of the male genitalia is best explained as the result of _____, and specifically of

A) disruptive selection; intrasexual selection B) natural selection; stabilizing selection C) sexual selection; intrasexual selection D) natural selection; intersexual selection E) sexual selection; disruptive selection

30) The correct sequence from the most to the least comprehensive of the taxonomic levels listed here is

A) phylum, kingdom, order, class, species, family, and genus. B) kingdom, phylum, class, order, family, genus, and species. C) family, phylum, class, kingdom, order, species, and genus. D) phylum, family, class, order, kingdom, genus, and species. E) kingdom, phylum, order, class, family, genus, and species.

Part II. 解釋名詞(每題4分)

1. Mangroves
2. Eutrophication
3. Red tide

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4. Biomass
5. Catadromy
6. Symbiosis
7. Biological control
8. Reef corals
9. Parthenogenesis
10. Autotrophs

國立中山大學 103 學年度碩士暨碩士專班招生考試試題

科目名稱：普通地質學【海資系碩士班乙組選考】

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問答題（每題 10 分）

- 1、學習與研究地質學有什麼重要性？(10%)
- 2、(a)請繪出一剖面圖說明地球的主要分層結構，並且標註地球的半徑以及各層的大約厚度。(7%)
(b)在板塊地體造學說（plate tectonics）中所定義的板塊（plates）指的是上述分層中的哪些部分？(3%)
- 3、我們在日常生活中常用到的金屬鋁來自於鋁土礦（bauxite），請問：
(a)鋁土礦是如何形成的？(6%)
(b)其在成因上屬於哪一種類型的礦床？(2%)
(c)鋁土礦中主要含什麼礦物？(2%)
- 4、(a)何謂 unconformity？(3%)
(b)Unconformity 的出現代表什麼地質意義？(3%)
(c)有哪幾種類型的 unconformity？(4%)
- 5、(a)何謂變質岩（metamorphic rocks）與變質作用（metamorphism）？(4%)
(b)變質作用依變質條件可以分為那些類型？(4%)
(c)台灣的中央山脈變質岩區屬於上述哪一種變質作用類型？(2%)
- 6、請寫出：
(a)地球的年齡(3%)
(b)地球現今各大洋中最老的海洋地殼之年齡(2%)
(c)台灣最古老的岩層所屬的地質年代或其年齡(2%)
(d)地質年代中以下三處時代界線的大約年齡：Archean 太古宙—Protorozoic 元古宙；Protorozoic 元古宙—Cambrian 寒武紀；Cretaceous 白堊紀—Tertiary 第三紀。(3%)
- 7、地下水是地表附近最大的液態淡水資源，請敘述：
(a)哪些種類的岩層分別是地下水的含水層（aquifers）與阻水層（aquitards）？(4%)
(b)形成自流井（artesian well）所需的地質條件（可繪圖輔助說明）(6%)。
- 8、台灣經常發生土石流或山崩地滑（或稱塊體運動，mass wasting）的災害，請敘述：
(a)影響塊體運動的因素(6%)
(b)有哪些方法可以用來防治一個可能發生塊體運動的不穩定邊坡？(4%)
- 9、岩漿（magma）是地底下的岩石發生部分熔融作用（partial melting）所產生的，請問：
(a)什麼樣的機制或作用可以使地底下的岩石部分熔融作用而產生岩漿？(6%)
(b)岩漿的化學組成？(4%)
- 10、有關岩石的鑑定與分類，請問：
(a)在野外我們要如何鑑定岩石？亦即要以什麼觀察結果作為根據來鑑別岩石的種類？(5%)
(b)請根據第 2 頁附圖一，說明要如何分辨花崗岩和輝長岩，並寫出彼等的主要組成礦物名稱，以及各礦物之含量大致百分比。(5%)

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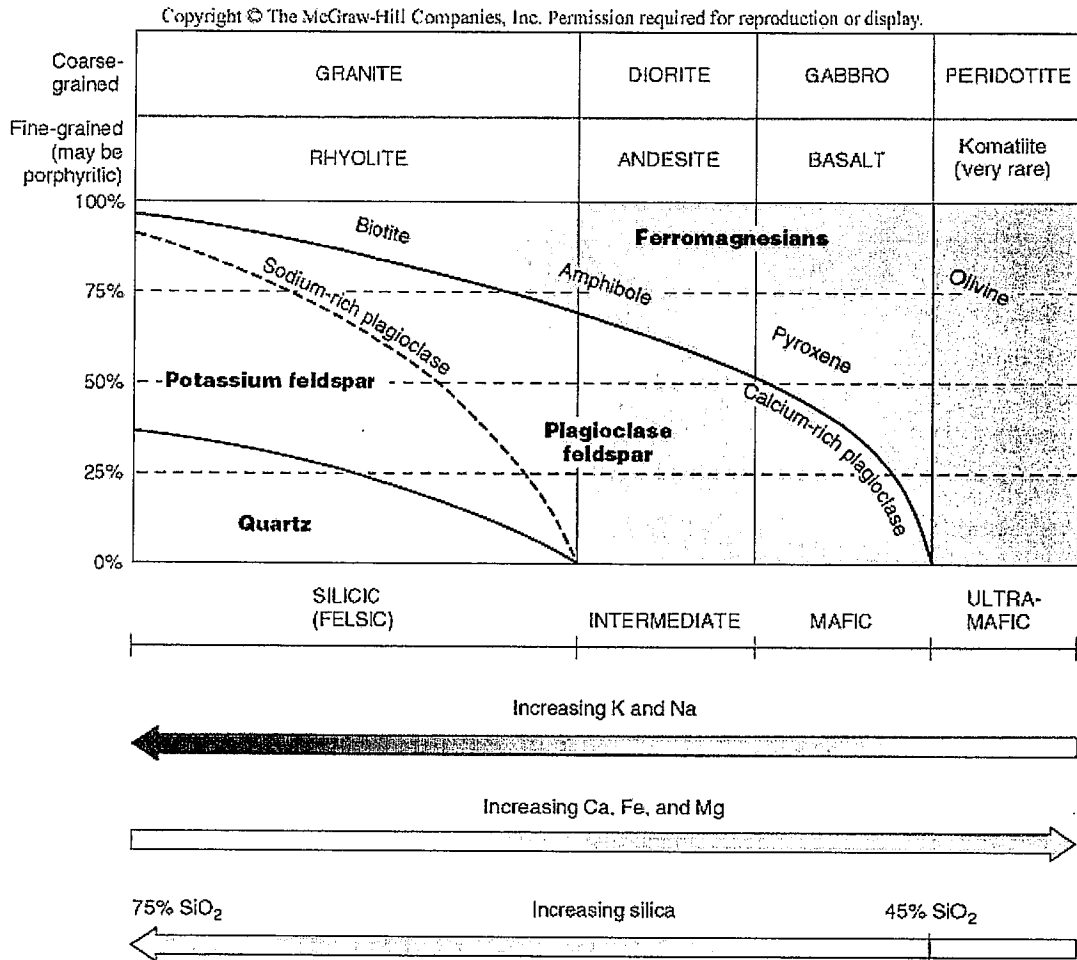
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附圖一

國立中山大學 103 學年度碩士暨碩士專班招生考試試題

科目名稱：分析化學【海資系碩士班丙組】

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請注意：(a)若涉及計算，請將演算過程列出，否則不予計分

(b) $\log 2 = 0.30$ $\log 3 = 0.48$

(c) 原子量：C = 12. O = 16. Na = 23. K = 39. Cr = 52

1. Why are the standard reagents used in neutralization titrations generally strong acids and bases rather than weak acids and bases? (5%)
2. Briefly explain why there is no term in an equilibrium constant expression for water or for a pure solid, even though one (or both) appears in the balanced net ionic equation for the equilibrium. (5%)
3. What weight of sodium formate must be added to 400.0 mL of 1.00 M formic acid (HCOOH) to produce a buffer solution that has a pH of 3.50? (pK_a of formic acid is 3.80) (8%)
4. The solubility of strontium fluoride in water is 1×10^{-3} M at room temperature. What is the value of the solubility product of SrF₂? (8%)
5. Calculate the molar solubility of AgCl in a 1.0 M NH₃ solution. (K_{sp} of AgCl is 1.6×10^{-10} , K_f of Ag(NH₃)₂⁺ is 1.0×10^7) (8%)
6. The iodine produced when an excess of KI was added to a solution containing 0.1259 g of K₂Cr₂O₇ required a 41.26 mL titration with Na₂S₂O₃. Calculate the molar concentration of the thiosulfate solution. (8%)
7. Calculate the ionic strength of a solution that is
 - (a) 0.040 M in FeSO₄
 - (b) 0.20 M in (NH₄)₂CrO₄
 - (c) 0.10 M in FeCl₃ and 0.20 M in FeCl₂ (9%, 3% each)
8. Why is it necessary to bubble hydrogen through the electrolyte in a hydrogen electrode? (5%)
9. Describe the difference between a galvanic cell and an electrolysis cell. (10%)
10. Define following terms
 - (a) elution.
 - (b) mobile phase.
 - (c) stationary phase.
 - (d) retention time. (12%, 3% each)
11. Describe the fundamental difference between adsorption and partition chromatography. (10%)
12. Describe the differences between the following and list any particular advantages possessed by one over the other:
 - (a) spectrophotometers and photometers. (6%)
 - (b) conventional and diode-array spectrophotometers. (6%)