

國立中山大學 102 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【海生聯合碩士班】

題號：468001

※本科目依簡章規定「不可以」使用計算機

共 4 頁 第 1 頁

單選題，每題兩分。不可於試題紙上作答。

1. Which of the following taxonomic categories contains organisms least similar to each other? (1), order; (2), species; (3), genus; (4), family.
2. The transformation from a single cell into an adult individual with many different kinds of cells is called (1), development; (2), inheritance; (3), evolution; (4), adaption.
3. Natural selection in different environments may result in (1), diversity; (2), similarity; (3), inheritance; (4), homeostasis.
4. Nucleic acid sequence is (1), positive in charge; (2), neutral in charge; (3), negative in charge.
5. Protein structure may NOT be denatured by (1), heat; (2), acid; (3), presence of oxygen gas; (4), proteases.
6. DNA sequences can be amplified by (1), CPR, cardiopulmonary resuscitation; (2), PCR, polymerase chain reaction; (3), RCP, reality co-processor.
7. Mitochondria are only inherited from (1), father; (2), mother; (3), both.
8. Which of the following bases is not DNA? (1), guanine; (2), thymine; (3), adenine; (4), uracil; (5), cytosine.
9. Which of the following molecules is responsible for energy transportation? (1), RNA; (2), ATP; (3), DNA; (4), Methane.
10. Which of the following descriptions is wrong? (1), enzymes are proteins; (2), enzymes can be denatured by acid; (3), enzymes are involved in chemical reactions; (4), the shape of enzyme can be reversibly altered by allosteric subunits.
11. Which of the following structures is absent from animal cells? (1), cell membrane; (2), nuclear envelope; (3), cell wall; (4), ribosome.
12. Which of the following descriptions is correct? (1), bacteria are eukaryotic cells; (2), cytoplasm is the region between the nucleus and the plasma membrane in a eukaryotic cell; (3), DNA moves regularly from the nucleus to the cytoplasm; (4), most DNA of a eukaryotic cell is present in the cytoplasm.
13. Which of the following descriptions is wrong? (1), phospholipids are the most abundant lipids in a cell membrane; (2), osmosis refers to the diffusion of water; (3), a membrane is hold together primarily by hydrophobic attractions; (4), increasing the size of molecules will increase the rate of diffusion.
14. The term anaerobic means (1), with oxygen; (2), without oxygen; (3), with nitrogen; (4), without nitrogen.
15. Glycolysis is present in (1), bacteria; (2), fungi; (3), eukaryotic cells; (4), virtually all kinds of cells.
16. In the production of wine, the glucose from fruit is converted by yeast to (1), ethanol; (2), heat; (3), oxygen; (4), DNA.

國立中山大學 102 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【海生聯合碩士班】

題號：468001

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 2 頁

17. Which of the following descriptions about autotroph is NOT true? (1), an autotroph sustains itself without eating other organism; (2), an autotroph gets its carbon from carbon dioxide; (3), mushroom is an autotroph; (4), an autotroph requires energy from light or inorganic chemical reactions to produce complex organic compounds.
18. Which of the following descriptions about photosynthesis is NOT true? (1), photosynthetic autotrophs get their energy from heat; (2), photosynthesis transforms light energy to chemical energy; (3), in plants, chloroplasts are the organelles conducting photosynthesis; (4), Photosynthesis occurs in plants, algae, and many species of bacteria.
19. Comparing to C3 plants, C4 plants are (1), more colorful; (2), more suitable to arid environments; (3), less efficient in using water; (4), taller.
20. Plants store glucose in the form of (1), cellulose; (2), sucrose; (3), fructose; (4), starch.
21. In mitosis, the number of chromosome sets in daughter cells is (1), half; (2), one fourth; (3), twice; (4), the same as the number in the parent cells.
22. If you discovered a creature having a fifth base in addition to G, A, T and C, it might imply that the creature (1), has nothing special; (2), evolves from birds; (3), is an alien since all organisms on earth share the same nucleotides, G, A, T and C; (4), evolves from fish.
23. Which of the following segments is the complementary sequence of GATTCCGAC? (1), GAAAGGTCC; (2), CTAAGGCTG; (3), GATTCCGAC; (4), GATTCCGAC.
24. Which of the following RNA sequences is transcribed from GATTCCGAC? (1), CUAAGGCUG; (2), CTAAGGCTG; (3), GATTCCGAC; (4), GATTCCGAC.
25. After transcription, DNA molecules (1), are wrapped in protein; (2), disintegrate into its component nucleotides; (3), move to the cytoplasm; (4), replicate itself.
26. Polypeptides are assembled on (1), vacuoles; (2), centrosomes; (3), ribosomes; (4), Golgi body.
27. Which of the following descriptions is NOT true? (1), body cells of an animal are different in structure and function because they synthesize different mRNA molecules; (2), there are 64 codons and each of them is composed of 4 nucleotides; (3), all body cells of an animal contain the same genes; (4), there are 23 chromosomes in human sperm cells.
28. Genes that code for polypeptides are called (1), functional genes; (2), structural genes; (3), regulatory genes; (4), optional genes.
29. Viral genomes are made of (1), either DNA or RNA; (2), either protein or fatty acid; (3), RNA; (4), DNA.
30. Which of the following descriptions about viruses is true? (1), the virus that causes AIDS is not a retrovirus; (2), viruses are obligate parasites of cells; (3), genomes of viruses are only made of DNA; (4), viruses have a nucleus.
31. Which of the following descriptions about bacteria is NOT true? (1), bacteria have no nucleus; (2), bacteria cannot acquire new genes by taking up DNA molecules from its surroundings; (3), bacteria are prokaryote; (4), bacteria can transfer genes from one individual to another.

國立中山大學 102 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【海生聯合碩士班】

題號：468001

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 3 頁

32. The blood types of a couple are AB and B, and their daughter has blood type O. Which of the following situations may NOT explain this? (1), her father is someone else; (2), the hospital made a mistake of her blood type; (3), nothing wrong.
33. Scientific names must be in (1), Latin; (2), Taiwanese; (3), Chinese; (4), English.
34. Natural selection acts on (1), genotype; (2), phenotype; (3), holotype; (4), neotype.
35. According to Biological Species Concept, individuals of the same species would be able to interbreed and reproduce (1), sterile offspring; (2), fertile offspring; (3), clones; (4), a new species.
36. Similar traits on distantly related organisms may result from (1), divergent evolution; (2), parallel evolution; (3), convergent evolution; (4), coevolution.
37. The study that describes the evolutionary history of species or other taxonomic ranking is called (1), taxonomy; (2), phylogeny; (3), entomology; (4), ichthyology.
38. Which of the following animals is NOT fish? (1), whale; (2), shark; (3), lamprey; (4), tuna.
39. Which of the following plant tissue is composed of dead cells? (1), xylem; (2), epidermis; (3), ground; (4), phloem.
40. Charles Darwin is great because he proposed the scientific theory of (1), universal gravitation; (2), homeostasis; (3), natural selection; (4), vicariance.
41. Which of the following descriptions is NOT true? (1), a flatworm can receive nutrients and oxygen by diffusion from its environments; (2), homeostasis occurs in all organisms to some extent; (3), gills are the major gas-exchange organ for most aquatic animals; (4), energy is stored in liver and muscle as fat.
42. Marine fish must continuously (1), excrete salt without drinking water; (2), drink water and excrete salt; (3), drink water without excreting salt.
43. A population is (1), a group of organisms of one species living in the same place at the same time; (2), a group of organisms of two species living in the same place at the same time; (3), a group of organisms of several species living in the same place at the same time; (4), a group of organisms of one species living in different places.
44. An animal that maintains its body at a metabolically favorable temperature is (1), a plant; (2), an endotherm; (3), an ectotherm; (4), fish.
45. Symbiosis is divided into three categories. Which of the following terms is NOT included? (1), mutualistic; (2), allopatric; (3), commensal; (4), parasitic.
46. External fertilization occurs almost exclusively in habitats that are (1), arid; (2), moist; (3), warm; (4), cold.
47. Which of the following gases is NOT greenhouse gas? (1), H₂O; (2), CO₂; (3), CH₄; (4), O₂.

國立中山大學 102 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【海生聯合碩士班】

題號：468001

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 4 頁

複選題，每題三分。不可於試題紙上作答。

48. Which two of the following cellular organelles can transform energy? (1), mitochondria; (2), chloroplasts; (3), cytosol; (4), lysosome.
49. Which two of the following persons discovered the double helix structure of DNA? (1), Francis Crick; (2), Charles Darwin; (3), James Watson; (4), Confucius.

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文閱讀測驗【海生聯合碩士班】

題號：468002

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 1 頁

1. Translate the following words into Chinese (10 points; 1 point each):

manipulation; strategy; accuracy; standardization; parameter; optimization; subjective; evidence; diagnosis, inductive reasoning

2. Translate the following words into English (10 points; 1 point each)

理論，預測，海洋學，變異性，虛無假設，海洋酸化，生態模擬，
全球暖化，試驗設計，生物多樣性

3. Translate the following passages into CHINESE (15 points) (Adapted from: Jack Lucentini. 2003. *Hydra of my heart*. DISCOVER, December 2003 24(12): 14. (附註: *Hydra*, 水螅; You do not need to translate the names of persons and city)

Two geneticists have identified link between the human heart and a group of contracting cells in *Hydra*, a simple creature that may resemble some of the earliest multicellular animals. The water-dwelling *Hydra* is basically a quarter-inch tube topped with a set of tentacles for dragging food into one end. The area around the other, sealed end of the tube, called peduncle (i.e., a stalk-like part of a structure), can contract in a pumping motion that helps mix nutrient. Hiroshi Shirmizu and Toshitaka Fujisawa of Japan's National Institute of Genetics propose that the heart may be evolved from the peduncle of *Hydra* or a similar creature.

Shimizu and Fujisawa injected ink into the peduncle and noted that the pumping action there is suggestive of the beating of a heart. Several clues indicate this similarity is no coincidence. *Hydra* has a gene that instructs nerve cells to produce a molecule that powers the peduncle's contractions. Higher organisms possess a related gene that similarly revs up (i.e., accelerates) the heart. Another gene active in the peduncle is related to one that, in higher organisms, functions prominently in embryonic heart tissue. This finding fits with evidence that embryos at times pass through stages resembling their species' ancestors, the researchers note.

The peduncle was apparently "refined during evolution and relocated more to the middle of the body," says Hans Meinhardt, a theoretical biologist at the Max Planck Institute for Developmental Biology in Tübingen, Germany. Even in humans, heart tissue originates at the tip of the embryo, where *Hydra*'s peduncle would be. Anatomic and genetic evidence suggest another surprise, he adds: *Hydra*'s mouth corresponds to our rear end.

4. Based on the following report, answer the two comprehension questions (A and B) (20 points). (Adapted from: Waters of change. *The Economist*. October 29th 2011: 82-84.)

It is not often that biologists have a chance to watch natural selection in action. The best-known cases—the evolution of resistance to antibiotics in bacteria and to pesticides in insects—are responses to deliberate changes people have made in the environment of the creatures concerned. But mankind has caused lots of accidental changes as well, and these also offer opportunities to study evolution.

Recently, two groups of researchers, one at New York University (NYU) and the other at the Woods Hole Oceanographic Institute in Massachusetts, have taken advantage of one of these changes to look at how fish evolve in response to environmental stress. The stress in question is pollution by polychlorinated biphenyls (PCBS). These chemical-widely used in the middle

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文閱讀測驗【海生聯合碩士班】

題號：468002

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 2 頁

decades of the 20th century to manufacture electrical insulation, coolants, sealants and plasticisers—often ended up dumped in lakes, rivers and coastal water. Eventually, such dumping was banned (in America, this happened in 1977). But PCBS are persistent chemicals, and their effects are felt even today. In particular, they disrupt the immune systems of animals such as fish, cause hormonal imbalances and promote tumours.

As in the way of evolution, however, some fish species have developed resistance to PCB poisoning. Issac Wirgin, at NYU, and Mark Hahn, at Woods Hole, have been studying PCB-resistant fish, to see how they do it. After that, the two researchers will be able to look at how these populations evolve yet again as the environment is cleaned up.

The species of interest to Dr. Wirgin is the Atlantic tomcod of the Hudson River in upstate New York. Part of the Hudson was polluted with PCBs by two General Electric plants. Dr. Hahn is looking at a different animal, the killifish. In New Bedford harbour, Massachusetts, which was polluted by other producers. Both Hudson tomcod and New Bedford killifish are able to tolerate levels of PCBs far higher than those that would kill such fish in cleaner waters. The question is, why?

PCBs do their damage by binding to a protein called the aryl hydrocarbon receptor, or AHR, thus stopping it working properly. AHR is a transcription factor, meaning that it controls the process by which messenger molecules are copied from genes. These messenger molecules go on to act as the blueprints for protein production, so preventing a transcription factor from working can cause all sorts of problems. Both Hudson tomcod and New Bedford killifish, however, have unusual AHR molecules. And it is this that seems to explain their immunity.

A protein is a chain of chemical units called amino acids. In tomcods, AHR is composed of 1,104 such units. Except that in Hudson tomcod it frequently isn't, these fish generally have 1,102 amino acids in their AHRs. The two missing links in the chain (a phenylalanine and a leucine) are encoded in the gene for ordinary tomcod AHR by six genetic "letters" that are missing from the DNA found in PCB-resistant Hudson tomcod. The shortened version of AHR does not bind nearly so easily to PCBs. It still, however, seems to work as a transcription factor. The result is fish that are more or less immune to PCB poisoning.

In the case of the New Bedford killifish the situation is similar, but more complicated. There are no missing amino acids. Dr. Hahn has, however, found nine places along the amino-acid chain of killifish AHR where the link in the chain varies between individuals. Altogether, he has identified 26 such variations. Two of them seem particularly resistant to the effects of PCBs. It is not that the pollutants do not bind to the protein—they do. But the protein does not seem to mind. It appears to work equally well, whether or not it has PCB passengers on board.

Questions:

(A). With regard to the main subject of this report, give the key sentence of the first paragraph? (2 points)

(B). Hudson tomcod and New Bedford killifish are able to tolerate higher levels of PCBs. What are the differences in their AHR and why they are more or less immune to PCB poisoning? ANSWER IN CHINESE (18 points)

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文閱讀測驗【海生聯合碩士班】

題號：468002

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 3 頁

5. Based on the following report, answer the four comprehension questions (A-D) (20 points). For multiple-choice question, select the SINGLE correct answer (單選). (Adapted from: The Economist. October 8th 2011, p. 88)

Most biological molecules—and hence, most living organisms—are ultimately the result of photosynthesis. Most, but not all. Some creatures are part of food chains that begin with methane gas which seeps from the Earth's interior in particular places, frequently at the bottom of the sea. Bacteria living in these seeps process the methane into complex molecules, and worms and clams feast on the bacteria. It now seems, though, that such methane-based food chains may stretch farther up the tree of life than mere invertebrates—and may have done so for millions of years.

Recently, as they report in Marine Ecology Progress Series, Tina Treude of the IFM-GEOMAR marine-research institute in Kiel, Germany, and her colleagues sent a remotely operated vehicle called Cherokee to investigate a seep known as the North Alex mud volcano, which is located in the Mediterranean, to the north of the Nile delta. Cherokee, which was equipped with a digital camera and a flashgun, started transmitting images of golden and dark-brown objects, 50-70 mm across, that were scattered among the worms and clams. The researchers quickly realized that these were sharks' eggs. Moreover, on closer examination they were able to see yolks, indicating that the embryos inside the eggs were alive and developing.

They do not know which species the eggs belong to, but Dr. Treude speculates they are from the deep water catshark, which is known to produce egg capsules of this size, colour and shape. And the North Alex volcano is not alone. She has found that another site, the Concepcion methane seep area, off the coast of Chile, is littered with thousands of large, black egg capsules of the sort often laid by skates and rays—fish that are, to all intents and purposes, flattened sharks.

In light of these discoveries her colleague Steffen Kiel, at the University of Gottingen, turned his attention to a fossilized methane seep in the American state of Washington. The rocks in this seep, which are 35m years old, were already known to contain lots of mussels and worm tubes, similar to those found in a modern seep. Lo and behold! When Dr. Kiel looked more closely, these rocks, too, contained fossil shark eggs.

Methane seeps, then, look as if they act as nurseries for sharks—and may have done so for a long time. Presumably (though this has still to be proved) the hatchling sharks are eating the worms and perhaps, if their teeth are up to the necessary crunching, the clams. Instead of being powered by the sun, then, some young sharks seem to run on fossil fuel.

Questions:

(A). What is the most suitable title for this report? A. New evidence for the embryonic development of deep-sea shark; B. What a gas!; C. Food chain in the deep-sea; D. New findings at the North Alex mud volcano. (2 points)

(B). The content of this report should be categorized to: A. Marine Phycology; B. Developmental Biology; C. Marine Ecology; D. Ethology. (2 points)

(C). Remotely operated vehicle is a: A. manned-submarine; B. boat; C. under-water robot; D. water scooter. (2 points)

(D). Give a condensed summary in CHINESE for the main subject and new findings given in

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文閱讀測驗【海生聯合碩士班】

題號：468002

※本科目依簡章規定「不可以」使用計算機

共 4 頁第 4 頁

this report. (14 points)

6. Write an ENGLISH essay no less than 200 words on the topic: Some characteristics of a good research advisor. (25 points)

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海科系碩士班乙組、丙組】

題號：458001

※本科目依簡章規定「不可以」使用計算機

共 2 頁第 1 頁

A. 閱讀能力測驗：每一題僅有一個正確或最佳答案；請於答案卷作答(每題 4 分，共 40 分)。

(1). Answer questions 1-5 according to the abstract of the following article:

Thomas Jacob, John Wahr, W. Tad Pfeffer & Sean Swenson, 2012. Nature, vol. 498, 514-518.

Glaciers and ice caps (GICs) are important contributors to present day global mean sea level rise¹. Most previous global mass balance estimates for GICs rely on extrapolation of sparse mass balance measurements representing only a small fraction of the GIC area, leaving their overall contribution to sea level rise unclear. Here we show that GICs, excluding the Greenland and Antarctic peripheral GICs, lost mass at a rate of $148 \pm 30 \text{ Gt yr}^{-1}$ from January 2003 to December 2010, contributing $0.41 \pm 0.08 \text{ mm yr}^{-1}$ to sea level rise. Our results are based on a global, simultaneous inversion of monthly GRACE-derived satellite gravity fields, from which we calculate the mass change over all ice-covered regions greater in area than 100 km^2 . The GIC rate for 2003–2010 is about 30 per cent smaller than the previous mass balance estimate that most closely matches our study period. The high mountains of Asia, in particular, show a mass loss of only $4 \pm 20 \text{ Gt yr}^{-1}$ for 2003–2010, compared with $47\text{--}55 \text{ Gt yr}^{-1}$ in previously published estimates. For completeness, we also estimate that the Greenland and Antarctic ice sheets, including their peripheral GICs, contributed $1.0 \pm 0.19 \text{ mm yr}^{-1}$ to sea level rise over the same time period. The total contribution to sea level rise from all ice-covered regions is thus $1.48 \pm 0.26 \text{ mm yr}^{-1}$, which agrees well with independent estimates of sea level rise originating from land ice loss and other terrestrial sources.

1. What is GIC?
(A) Global Information Commission. (B) Geographic Information Certificate.
(C) Glaciers and Ice Caps. (D) Generalized Information Change.
2. According to this passage, which place may have the least contribution to sea level rise?
(A) The high mountains of Asia. (B) Greenland.
(C) Alaska. (D) Antarctica.
3. Which instrument may be used in this research?
(A) Water level indicator. (B) Depth measuring instrument.
(C) In-situ pressure meter. (D) Satellite.
4. How many data sets in one study area can the author get?
(A) 8. (B) 96. (C) 192. (D) 768.
5. What is the best title for this article?
(A) Estimating earth variations from a combination of GRACE and ocean model output.
(B) Recent contributions of glaciers and ice caps to sea level rise.
(C) Global sea level rise, recent progress and challenges for the decade to come.
(D) Icefield melting observed by gravity recovery and climate experiment (GRACE).

(2). Answer questions 6-10 according to the abstract of the following article:

Huber, M. and Knutti, R., 2011. Nature Geoscience, vol. 5, 31-36.

The Earth's energy balance is key to understanding climate and climate variations that are caused by natural and anthropogenic changes in the atmospheric composition. Despite abundant observational evidence for changes in the energy balance over the past decades, the formal detection of climate warming and its attribution to human influence has so far relied mostly on the difference between spatio-temporal warming patterns of natural and anthropogenic origin. Here we present an alternative attribution method that relies on the principle of conservation of energy, without assumptions about spatial warming patterns. Based on a massive ensemble of simulations with an intermediate-complexity climate model we demonstrate that known changes in the global energy balance and in radiative forcing tightly constrain the magnitude of anthropogenic warming. We find that since the mid-twentieth century, greenhouse gases contributed $0.85 \text{ }^\circ\text{C}$ of warming (5–95% uncertainty: $0.6\text{--}1.1 \text{ }^\circ\text{C}$), about half of which was offset by the cooling effects of aerosols, with a total observed change in global temperature of about $0.56 \text{ }^\circ\text{C}$.

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海科系碩士班乙組、丙組】

題號：458001

※本科目依簡章規定「不可以」使用計算機

共 2 頁第 2 頁

The observed trends are extremely unlikely (<5%) to be caused by internal variability, even if current models were found to strongly underestimate it. Our method is complementary to optimal fingerprinting attribution and produces fully consistent results, thus suggesting an even higher confidence that human-induced causes dominate the observed warming.

6. According to the passage, the best way to understand climate is to study what?
(A) Natural and anthropogenic changes. (B) Spatial warming patterns.
(C) The Earth's energy balance. (D) Climate variations.
7. What method is unlikely to be used in the research?
(A) Climate simulation. (B) Statistical analysis.
(C) Model computation. (D) Field trip.
8. What is the best title for this article?
(A) Anthropogenic and natural warming inferred from changes in Earth's energy balance.
(B) The signal of ocean global warming.
(C) Greenhouse-gas emission targets for global warming.
(D) The detection and attribution of climate change.
9. About half of the earth can be neutralized by what?
(A) Carbon dioxide. (B) Aerosols. (C) Organic carbon. (D) Radiative forcings.
10. Which forcing contributes the most to global temperature change?
(A) Natural forcing. (B) Greenhouse gases.
(C) anthropogenic forcing. (D) Aerosols.

B. 基本字彙測驗：寫出下列各英文名詞的中文(每題 3 分，共 15 分)。

1. Kuroshio 2. Tidal flat 3. Subduction 4. Overfishing 5. Carbon emission

C. 基本字彙測驗：寫出下列各中文名詞的英文(每題 3 分，共 15 分)。

1. 轉型斷層 2. 富營養鹽 3. 光合作用 4. 天然氣水合物 5. 海岸帶

D. 英文表達測驗：將下列段落文字以大意(非逐字)方式翻寫成英文，評分以文法和拼字的正確及文句通順程度為標準(每題 15 分，共 30 分)。

1. 由於全球的暖化造成極地冰蓋和高山、高原區的冰川融解，使得全球的海平面上升，嚴重的威脅到沿著海岸居住的人類，特別是沿海的超級城市，如紐約和上海。
2. 由於歐亞板塊和菲律賓海板塊的碰撞和擠壓，形成了台灣多山的陡峭地形，也造成了台灣地震的頻繁。台灣又位於西太平洋颱風的走廊上，每年平均有四次颱風的襲擊。陡峭地形，地震造成的山崩，再加上颱風帶來的強降雨，使得台灣河川單位流域的輸砂量在全球名列前茅。

國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：化學【海科系碩士班乙組選考】

題號：458003

※本科目依簡章規定「不可以」使用計算機

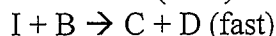
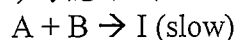
共 1 頁第 1 頁

一、(30%)解釋下列名詞：

- (1) Functional group
- (2) Double bond
- (3) Henry's law
- (4) Anion
- (5) Equilibrium
- (6) Electronegativity
- (7) Avogadro's law
- (8) Isomers
- (9) Salt bridge
- (10) sp^3 hybridization

二、(10%) 地球大氣層中因人類燃燒化石燃料造成二氧化碳濃度急速且大幅增加，海水因為會吸收二氧化碳(也可釋放)，大氣中二氧化碳濃度升高也會影響海水的化學狀態。考慮海水與大氣間的化學平衡，二氧化碳可溶於水中，(1)寫出二氧化碳溶於水後生成的產物為何？(2)此產物在水中會解離，寫出該產物在水中解離的完整系列化學平衡式。(3)根據此系列平衡式，判斷並說明大氣中二氧化碳濃度升高時對海水 pH 值的影響(升高或降低？變化原因)。

三、(10%) 考慮下列反應動力機制：



(1)寫出淨反應式。(2)上述反應的速率定律式(rate law)為何？

四、(15%)化學分析的儀器測量上經常使用外標準品分析結果製成檢量線推算未知樣品濃度，但有時不能獲得準確的樣品濃度，而必須利用"標準添加法"。說明(1)使用標準添加法的時機(甚麼狀況使用標準添加法較適當)；(2)標準添加法的執行步驟；(3)如何以標準添加法計算未知樣品濃度。

五、(15%)分析化學在確定誤差之發生及評估誤差之大小，常以重複分析的方式求得量化結果，說明下列各量化值的意義及計算方式：(1)平均值；(2)平均偏差；(3)標準差；(4)相對標準差；(5)全距。

六、(10%)說明層析法的(1)原理；(2)重要元件；(3)應用(分析實例)。

七、(10%)某實驗室計畫出海採集台灣海峽海水樣品，共規劃 40 測站，每站分別採集不同 10 個深度樣品各一個，其中一項分析需於採樣後立即添加 1 mL 的 0.5 M 之硫代硫酸鈉($\text{Na}_2\text{S}_2\text{O}_3$)於樣品中。若你負責準備此試劑，說明你配製足夠上述出海航次樣品使用之硫代硫酸鈉試劑一瓶的步驟。註：硫代硫酸鈉於室溫中含 5 個結晶水。若有需量化但無法計算出數值的答案須列出算式。(原子量 Na: 23; S: 32; O: 16; H: 1)

國立中山大學 102 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【海科系碩士班乙組選考】

題號：458007

※本科目依簡章規定「不可以」使用計算機

共 1 頁第 1 頁

- 一、名詞解釋 (20%)
 1. meander (2%)
 2. island arc (2%)
 3. weathering (2%)
 4. focus (2%)
 5. lineation (2%)
 6. foliation (2%)
 7. unconformity (2%)
 8. strata (2%)
 9. diagenesis (2%)
 10. lagoon (2%)
- 二、請以地質學的角度出發，探討地質作用在全球碳循環中的重要性。(10%)
- 三、海洋中沉積物的來源主要有哪些？(10%)
- 四、請列出五種地質構造，並簡述其成因。(10%)
- 五、請舉例說明均變說(Uniformitarianism)的內涵及在地質學中的應用。(10%)
- 六、請描述大陸漂移、海底擴張及板塊構造學說的內容及其發展歷史。(10%)
- 七、請簡述台灣造山運動的歷程，並解釋台灣島形成的可能機制為何。(10%)
- 八、在海洋地質的研究上，常用哪些方法來決定沉積物岩心的年代？(10%)
- 九、下圖是台灣的海洋科學家於冬天時在高屏峽谷佈放之沉積物收集器(sediment trap)所取得的沉積物組成，及沉積物收集器上的流速儀所記錄的流速資料，試從圖中沉積物含水率與粒徑變化，及與潮汐流速之關係，討論高屏峽谷冬季時的沉積物輸送模式與控制機制。(流速為正值時，表示潮汐的運動方向為向陸地方向運動(漲潮)，反之則為退潮情況)(10%)

