

國立中山大學 106 學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海科系碩士班甲組、乙組】

題號：458001

※本科目依簡章規定「不可以」使用計算機(混合題)

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I. 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 3 分，共 30 分）。

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

Markus Huber and Reto Knutti, 2012. *Nature Geoscience* 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 °C of warming (5–95% uncertainty: 0.6–1.1 °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 °C. 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.

1. What do you think the title of this article is?
(A) Comparing climatic models and their accuracy
(B) Climatic warming and human influence
(C) Anthropogenic and natural warming inferred from changes in Earth's energy balance
(D) Application of the principle of conservation of energy on global warming
2. Which process contributed the most to global warming? (A) aerosols cooling (B) radiative forcing (C) internal variability (D) greenhouse gases
3. How was the formal detection of climatic changes based on in the past? (A) difference between spatio-temporal warming patterns (B) energy balance (C) conservation of energy (D) radiative forcing
4. What factors contributed to climatic changes and variations? (A) Earth energy (B) natural changes (C) conservation of energy (D) natural and anthropogenic changes
5. What is the contribution of this article? (A) using massive ensemble of simulations with an intermediate-complexity climate model (B) suggesting an even higher confidence that human-induced causes dominate the observed warming (C) relying on the principle of conservation of energy with assumptions about spatial warming patterns (D) all of the above

Answer questions 6-10 according to abstract of the following article:

Miquel Canals¹, Pere Puig², Xavier Durrieu de Madron³, Serge Heussner³, Albert Palanques² & Joan Fabres¹, 2006. *Nature* 444, 354-357.

The continental slope is a steep, narrow fringe separating the coastal zone from the deep ocean. During low sea-level stands, slides and dense, sediment-laden flows erode the outer continental shelf and the continental slope, leading to the formation of submarine canyons that funnel large volumes of sediment and organic matter from shallow regions to the deep ocean. During high sea-level stands, such as at present, these canyons still experience occasional sediment gravity flows, which are usually thought to be triggered by sediment failure or river flooding. Here we present observations from a submarine canyon on the Gulf of Lions margin, in the northwest Mediterranean Sea, that demonstrate that these flows can also be triggered by dense shelf water cascading (DSWC)—a type of current that is driven solely by seawater density contrast. Our results show that DSWC can transport large amounts of water and sediment, reshape submarine canyon floors and rapidly affect the deep-sea environment. This cascading is seasonal, resulting from the formation of dense water by cooling and/or evaporation, and

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occurs on both high- and low-latitude continental margins. DSWC may therefore transport large amounts of sediment and organic matter to the deep ocean. Furthermore, changes in the frequency and intensity of DSWC driven by future climate change may have a significant impact on the supply of organic matter to deep-sea ecosystems and on the amount of carbon stored on continental margins and in ocean basins.

6. What do you think the title of this article is?
 - (A) Formation of submarine canyons
 - (B) Flushing submarine canyons
 - (C) Dense shelf water cascading in the Mediterranean Sea
 - (D) Transport of sediment and organic matter from shallow regions to the deep ocean
7. How was dense shelf water cascading formed? (A) rising sea surface temperature (B) dissipation of hurricane power (C) river flooding or sediment failure (D) seawater density contrast
8. What separates the coastal zone from the deep ocean? (A) continental shelf (B) continental slope (C) sediment gravity flows (D) submarine canyons
9. The dense shelf water cascading happens on what time scale? (A) yearly (B) episodic during storms (C) seasonal (D) unpredictable
10. How does future climate change affect dense shelf water cascading? (A) changes in its the frequency and intensity (B) impact on supply of organic matter to deep-sea ecosystems (C) amount of carbon stored on continental margins and in ocean basins (D) all of the above

II. 基本字彙測驗：寫出下列各英文名詞的中文(每題 2 分，共 20 分)。

1. Ocean circulation
2. Continental slope
3. Oceanic ridge
4. Water mass
5. Carbon cycle
6. Photosynthesis
7. Global climate change
8. Kuroshio intrusion
9. Isopycnal surface
10. Estuary

III. 基本字彙測驗：寫出下列各中文名詞的英文(每題 2 分，共 20 分)。

1. 海水表面溫度
2. 海洋浮游植物
3. 天然氣水合物
4. 海洋酸化
5. 板塊運動
6. 台灣海峽
7. 海槽
8. 溫-鹽圖
9. 沉積物
10. 海洋食物鏈

IV. 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. 人類排放的二氧化碳，平均每年有 35% 排到海裡，大量二氧化碳進入海洋，溶解後形成碳酸，過程中釋放氫離子，導致海水變酸。工業革命以來，海洋平均酸鹼值從 8.21 降到 8.10，並且以每年增加 0.02 的速度，持續酸化。酸化的海水會讓珊瑚白化，將熱鬧的珊瑚礁生態系統化為寂靜死城。
2. 全球暖化到底是人類所導致的，還是自然的變化，不同領域的科學家有不同的看法。古海洋和古環境學家認為是地球系統的自然變化，但是大氣、水文、海洋學家則認為主要是因人類活動而造成的。

國立中山大學 106 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【海科系碩士班甲組】
458005

題號：

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海洋科學系 106 年 碩士班 入學考試 普通生物學

單選題

(1 - 32 題每題三分)

1. Which in the following is not a common property of life?

(a) reproduction (b) vision (c) energy processing (d) response to the environment

2. Which term in the following can be defined as "all of the individuals of a particular species living in an area" ?

(a) ecosystem (b) community (c) population (d) organism

3. Which group in the following is not one of the three domains of life?

(a) bacteria (b) archaea (c) eukarya (d) fungi

4. Which element in the following occupies the highest percentage of human body weight (including water)?

(a) carbon (b) hydrogen (c) oxygen (d) nitrogen

5. Starch is a polymer of

(a) glucose (b) fructose (c) amino acids (d) lipids

6. A shortage of phosphorus in the soil would make it especially difficult for a plant to synthesize

(a) protein (b) DNA (c) starch (d) cellulose

7. Which is the following can form the most hydrogen bonds with water?

(a) chlorophyll (b) cholesterol (c) fatty acids (d) glucose

8. What kind of molecules in the following is the major component in cell membrane?

(a) phospholipids (b) protein (c) triacylglycerol (d) cholesterol

9. The major function of mitochondria is to synthesize

(a) RNA (b) DNA (c) ATP (d) ADP

10. The primary function of chloroplasts is to synthesize ATP and

(a) NADPH (b) amino acids (c) triacylglycerol (d) ribosome

11. In eukaryotic cells, chromatin is located in

(a) lysosome (b) nucleus (c) ribosome (d) Golgi body

12. The major difference between plant cells and animal cells is

(a) plasmamembrane (b) microtubule (c) cell wall (d) endoplasmic reticulum

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13. The process to engulf particles into cells is called
(a) endosymbiosis (b) endocytosis (c) exocytosis (d) endomembrane
14. Transport a molecule across a membrane against its concentration gradient is classified as
(a) active transport (b) passive transport (c) simple diffusion (d) facilitated diffusion
15. In chloroplasts, the pigments for light energy absorption is located in the
(a) outer membrane (b) inner membrane (c) thylakoid membrane (d) stroma
16. The first product in photosynthesis is
(a) sugar (b) amino acids (c) lipids (d) calcium
17. The source of the electron in the photosynthetic electron transport is
(a) sugar (b) lipids (c) amino acids (d) water
18. Gametes are produced by a process called
(a) respiration (b) meiosis (c) mitosis (d) diffusion
19. DNA contains four kinds of nitrogenous bases, but not including
(a) cytosine (b) uracil (c) adenine (d) thymine
20. It takes many factors to carry out polypeptide synthesis in mRNA translation, but not including
(a) transcription factor (b) tRNA (c) ribosome (d) amino acids
21. In the evolution of plants from early to lately in time series, what sequence below is correct?
(a) Ferns → Mosses → Gymnosperms → Angiosperms
(b) Angiosperms → Gymnosperms → Mosses → Ferns
(c) Mosses → Ferns → Gymnosperms → Angiosperms
(d) Gymnosperms → Angiosperms → Ferns → Mosses
22. Which lineages in the following is the ancestor of land plants?
(a) diatoms (b) dinoflagelates (c) green algae (d) kelps
23. Which group in the following is not a lineage in the Bilaterians?
(a) Chordates (b) Cnidarians (c) Molluscs (d) Nematodes
24. Which group in the following is the closest living nonvertebrate relatives of vertebrates?
(a) molluscs (b) flatworms (c) sponges (d) lancelets
25. Which of the following animals is not a member of the anthropoids?
(a) tarsier (b) chimpanzee (c) New World monkey (d) human

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26. In the evolution of animal structures from early to lately in time series, what sequence below is correct?

- (a) head → brain → vertebral column → jaws
- (b) brain → head → vertebral column → jaws
- (c) vertebral column → head → brain → jaws
- (d) jaws → head → brain → vertebral column

27. Which group in the following is thought to be the earliest branch of the animal kingdom?

- (a) sponges (b) cnidarians (c) flatworms (d) nematodes

28. Which group in the following has a body form of radial symmetry?

- (a) arthropods (b) chordates (c) echinoderms (d) cnidarians

29. Which structure in the following produces pollen in flowering plants?

- (a) stigma (b) sepal (c) petal (d) anther

30. Which group in the following produces spores in their life cycle?

- (a) angiosperms (b) monocots (c) gymnosperms (d) ferns

31. Fungi have many applications, but which in the following is not included?

- (a) They can be used as food.
- (b) They can be used to produce soy sauce.
- (c) They can be used to produce medicine.
- (d) They can be used in milk production.

32. Algae have many applications, but which in the following is not included?

- (a) They can be used as feed.
- (b) They can clean wastewater.
- (c) They can produce oxygen.
- (d) They can produce precious flowers.

(下題四分)

33. Lichens are symbiotic associations of a few forms of lives, but not including

- (a) Fungi (b) algae (c) mosses (d) cyanobacteria

國立中山大學 106 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：458002

※本科目依簡章規定「不可以」使用計算機(問答申論題)

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一、寫出下列化學物質的符號或化學式：(10%)

- (1) gold
- (2) potassium
- (3) radon
- (4) protactinium
- (5) selenium
- (6) ethyl alcohol
- (7) hydrogen sulfide
- (8) sodium nitrate
- (9) calcium carbonate
- (10) acetic acid

二、解釋下列名詞：(20%)

- (1) Sublimation
- (2) Coordination number
- (3) Supercritical fluid
- (4) Hydrolysis
- (5) Polymorphism
- (6) Henry's Law
- (7) Reverse osmosis
- (8) Dipole moment
- (9) Rate constant
- (10) Phase diagram

三、甚麼是水溶液的離子強度?如何定量?(10%)

四、說明滴定法在化學分析上的應用原理、簡要步驟，並舉例。(10%)

五、說明自然環境中鐵、硫、碳、氮分別可參與的氧化還原作用，參與作用得該元素物種及氧化數為何?(15%)

六、說明自然樣品中放射性同位素活性的測量原理、方法、及其可能應用。(15%)

七、統計是科學上處理數據的慣用工具，在化學分析上，如何利用統計工具來了解分析結果的品質?有哪些可量化的項目是常用且重要的誤差分析參數?這些參數如何評估分析誤差?(20%)

國立中山大學 106 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：458006

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一、單選題(10%，每題 2 分)

1. 請選出下列敘述何者錯誤？(A)地函(mantle)佔有地球內部最大的體積；(B)地球的地核(core)主要由矽酸鹽類物質組成；(C)地球的年齡約有 45 億年；(D)放射性元素的衰變是地球內部主要熱的來源；(E)大陸地殼(crust)厚度可達 70 公里
2. 關於中生代的敘述何者正確？(A)地表的開花植物在中生代時登上陸地；(B)兩棲類在中生代時演化出來；(C)菊石是中生代時海洋中的代表性生物之一；(D)哺乳動物在中生代時已經在地球環境中佔據生存優勢；(E)中生代時，地球氣候非常寒冷，冰河隨處可見
3. 風化對地表環境的演化不具有何種重要性？(A)是形成沉積物顆粒的重要機制；(B)可以加速地表岩石的破壞與地景的形成；(C)可以釋出溶解態物質到海洋中，是海水具有鹽度的重要原因之一；(D)可以加速大氣二氧化碳濃度的吸收；(E)風化的加劇，有利於火山作用的進行
4. 變質岩的形成與何種營力無關？(A)熱力；(B)潮汐；(C)壓力；(D)熱液作用；(E)風化作用
5. 形成斷層(fault)的原因與何者無關？(A)地殼斷裂；(B)中洋脊形成；(C)板塊擠壓；(D)火山作用；(E)成岩作用

二、名詞解釋(請寫出中文專有名詞，並解釋其意思)(30%，每題 3 分)

- (a) Plate boundary
- (b) Metamorphic Rock
- (c) Diagenesis
- (d) Sediment
- (e) Trench
- (f) Tsunami
- (g) Joint
- (h) Fossilization
- (i) Precambrian
- (j) Epicenter

三、申論題(60%)

1. 請解釋臺灣島上脊樑山脈與海岸山脈的成因，並討論其與馬尼拉隱沒帶和琉球隱沒帶的關聯性。(12%)
2. 請解釋何謂風化作用？何謂侵蝕作用？這兩者與海洋沉積物之間的關聯性為何。(12%)
3. 可以在臺灣本島何處找到安山岩地層？安山岩地層的存在有何科學意義及解釋？(12%)
4. 如何利用地球物理方法研究海底地形構造及評估甲烷水合物蘊藏量？(12%)
5. 2009 年，莫拉克颱風造成嚴重的地質災害，導致小林村滅村，請從地質學的角度探討，小林村發生的地質災害是否與人為過度開發有關？(12%)

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科目名稱：微積分【海科系碩士班乙組選考】

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1. 證明以下的微分式成立

$$(a) \frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}} \quad (10\%)$$

$$(b) \frac{d}{dx} \tan^{-1} x = \frac{1}{1+x^2} \quad (10\%)$$

2. 計算以下對 x 的積分

$$(a) \int (x+1)^4 dx \quad (5\%)$$

$$(b) \int \sin^2 x \cos x dx \quad (5\%)$$

3. (a) 以 Taylor Series 將 $\sqrt[3]{1+x}$ 對 x 展開至 x^2 階 (10%)

(b) 利用以上結果求 $\sqrt[3]{217}$ 的近似值 (10%)

4. a 為大於 0 的常數，已知 $(x-1)^2 + (y-2)^2 = 1$ ，求

$$(a) \frac{dy}{dx} \quad (5\%)$$

(b) 通過點(1,1)的切線斜率 (5%)

(c) 通過點(1,1)的切線方程式 (10%)

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5. 假設波動，以每小時 $\sqrt[3]{x}$ 公里的速度向 $+x$ 方向傳播，求

(a) 在 x 公里處，波經過 dx 距離需要多少小時？(5%)

(b) 多少小時後，波會由座標 $x=0$ 抵達 $x=300$ 公里處？(10%)

6. 求極限

(a) $y = \sqrt{x \tanh x}$ ，求 $\lim_{x \rightarrow 0} \frac{y}{x}$ 與 $\lim_{x \rightarrow 0} \frac{dy}{dx}$ 。(10%)

(b) $\lim_{x \rightarrow 0} \frac{(x+6)^3 - 216}{x}$ (5%)。