

## 國立中山大學100學年度碩士班招生考試試題

科目：化學【海地化所碩士班甲組】

未平衡反應式須先行平衡，計算題請寫出計算過程(否則扣分)

一、解釋下列名詞：(30%)

- (1) Standard electrode potential
- (2) Electron capture
- (3) Carbohydrate
- (4) Complex
- (5) Equilibrium
- (6) Henry's law
- (7) Colligative property
- (8) Idea gas law
- (9) Stereoisomers
- (10) Diffusion

二、(10%)一般粉筆是石灰石(limestone,  $\text{CaCO}_3$ )與石膏(gypsum,  $\text{CaSO}_4$ )為主的固體混合物，其餘成分視為微量可忽略；石灰石溶於鹽酸溶液而石膏不溶，該溶解反應的未平衡反應式為：



- (1) 試問一支質量 12.3 克，含有 69.7%石灰石的粉筆溶於過量鹽酸溶液中，產生的二氧化碳質量為何？
  - (2) 另一支粉筆質量為 4.38 克，置於過量鹽酸溶液中後產生 1.31 克二氧化碳，計算這隻粉筆中石灰石所占重量百分比。
- (原子量 Ca: 40; C: 12; O: 16; H: 1; Cl: 35.5)

三、(10%)考慮一硫酸銀( $\text{Ag}_2\text{SO}_4$ )飽和水溶液: ( $K_{\text{sp}} = 1.4 \times 10^{-5}$ )

- (1) 計算該飽和水溶液中銀離子濃度。
- (2) 若欲將 500 mL 的上述飽和水溶液的銀離子濃度降低到  $4.0 \times 10^{-3}$  M，須加入多少質量的硫酸鈉( $\text{Na}_2\text{SO}_4$ )? (原子量 Ag: 108; Na: 23; S: 32; O: 16)

四、(15%)欲測定某未知成分礦物中鐵的含量，有許多不同方法，舉出三種利用不同分析儀器的方法，分別說明該方法測量鐵的原理，並說明測定前必要的樣品前處理方式。

五、(20%)分析化學數據的品質對其代表的意義具有絕對重要性，說明下列各項在化學分析上的定義及重要性：

- (1) 精確度與準確度。

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- (2) 信賴界限。
- (3) 有效數字。
- (4) 空白值。

六、(15%)某無機實驗室使用的酸僅包括鹽酸、硝酸及硫酸。實驗室中有一瓶僅剩一半的未稀釋酸液，該酸液及瓶中上層氣體呈淡棕色，因為標籤遭酸蝕僅可知下列資訊：

Assay 70%

Specific gravity at 25°C 1.417

依以上資訊，回答下列問題：

- (1) 瓶中所裝的是何種酸液？
- (2) 該酸液相當於多少莫爾濃度(molarity)？
- (3) 欲配製 1.0 L, 1.0 N 溶液，需要瓶中酸液的多少體積？  
(原子量 H: 1; Cl: 35.5; N: 14; S: 32; O: 16)

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科目：普通地質學【海地化所碩士班乙組】

## 一、名詞解釋 (30%)

1. transform fault (3%)
2. fold (3%)
3. lineation (3%)
4. epicenter (3%)
5. strata (3%)
6. erosion (3%)
7. unconformity (3%)
8. weathering (3%)
9. plate tectonics (3%)
10. sediment (3%)

二、請簡單說明地質學的內涵及可能的應用，並提出三個地質學常用的原理 (principle)。 (20%)

三、試說明地球的內部構造，及地震可能的發生機制。 (20%)

四、民國 99 年 4 月 25 日國道三號七堵段邊坡發生嚴重崩塌事件，請以地質學的角度說明發生崩塌的可能原因為何？ (20%)

五、目前全球暖化議題發燒，另外我們又觀察到最近火山及地震事件頻傳。以您的專業觀點出發思考，您認為全球暖化與火山及地震活動之間是否有關聯？試說明之。 (10%)

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科目：科學英文【海地化所碩士班】

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60分）。

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

Elsner, J.B., Kossin, J.P., and Jagger, T.H., 2008. *Nature* 455, 92-95.

*Atlantic tropical cyclones are getting stronger on average, with a 30-year trend that has been related to an increase in ocean temperatures over the Atlantic Ocean and elsewhere. Over the rest of the tropics, however, possible trends in tropical cyclone intensity are less obvious, owing to the unreliability and incompleteness of the observational record and to a restricted focus, in previous trend analyses, on changes in average intensity. Here we overcome these two limitations by examining trends in the upper quantiles of per-cyclone maximum wind speeds (that is, the maximum intensities that cyclones achieve during their lifetimes), estimated from homogeneous data derived from an archive of satellite records. We find significant upward trends for wind speed quantiles above the 70th percentile, with trends as high as  $0.36 \pm 0.09 \text{ ms}^{-1}\text{yr}^{-1}$  (s.e.) for the strongest cyclones. We note separate upward trends in the estimated lifetime-maximum wind speeds of the very strongest tropical cyclones (99th percentile) over each ocean basin, with the largest increase at this quantile occurring over the North Atlantic, although not all basins show statistically significant increases. Our results are qualitatively consistent with the hypothesis that as the seas warm, the ocean has more energy to convert to tropical cyclone wind.*

1. How many reasons are given to explain why other tropics show less obvious cyclone intensity than Atlantic Ocean? (A) 5 (B) 4 (C) 3 (D) 2
2. What observational tool was primarily used to collect data in this article? (A) Current meters. (B) Satellites. (C) Microscopes. (D) Thermometers.
3. Which area was not included in the research area? (A) The Pacific Ocean. (B) The Indian Ocean. (C) The Arctic Ocean. (D) Mediterranean Sea.
4. What types of data were most likely analyzed to reach the conclusion in this study? (A) Photosynthetic plants and plankton. (B) Sea surface temperature and wind speed. (C) Sediment core. (D) Monsoon and rainfall records.
5. According to the article, which statement is false? (A) Only Atlantic tropical cyclones are influenced by ocean temperatures. (B) The warmer the seas become, the more likely tropical cyclone wind occur. (C) The intensity of the tropical cyclones has positive correlation with wind speeds. (D) Climate change has potential influence on tropical cyclone activity.

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

Emanuel, K., 2005. *Nature* 436, 686-688.

*Theory and modelling predict that hurricane intensity should increase with increasing global mean temperatures, but work on the detection of trends in hurricane activity has focused mostly on their frequency and shows no trend. Here I define an index of the potential destructiveness of*

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*hurricanes based on the total dissipation of power, integrated over the lifetime of the cyclone, and show that this index has increased markedly since the mid-1970s. This trend is due to both longer storm lifetimes and greater storm intensities. I find that the record of net hurricane power dissipation is highly correlated with tropical sea surface temperature, reflecting well-documented climate signals, including multidecadal oscillations in the North Atlantic and North Pacific, and global warming. My results suggest that future warming may lead to an upward trend in tropical cyclone destructive potential, and—taking into account an increasing coastal population—a substantial increase in hurricane-related losses in the twentyfirst century.*

6. Which terminology belongs to a different category? (A) Typhoon. (B) Cyclone. (C) Hurricane. (D) Anticyclone.
7. What factor will probably not strengthen the storm intensity? (A) Rising sea surface temperature. (B) Dissipation of hurricane power. (C) Seawater pollution. (D) Global warming.
8. According to the article, which factor may also contribute to the destructive force of tropical cyclones? (A) Human activities. (B) Hurricanes. (C) Earthquakes. (D) Increasing coastal population.
9. What is the best title for this article? (A) The side effect of global warming. (B) The strongest Atlantic tropical cyclones in history. (C) Increasing destructiveness of tropical cyclones over the past 30 years. (D) Ways to observe tropical cyclones.
10. What time scale is the most appropriate to the author's study? (A) Centurial. (B) Seasonal. (C) Annual. (D) Millennial.

**Answer questions 11-15 according to abstract of the following article:**

Dadson, S.J., Hovius, N., Chen, H., Dade, W.Br., Hsieh, M-L., Willett, S.D., Hu, J.-C., Horng, M.-J., Chen, M.-C., Stark, C.P., Lague, D., and Lin, J.-C. *Nature* 426, 648-651.

*The erosion of mountain belts controls their topographic and structural evolution and is the main source of sediment delivered to the oceans. Mountain erosion rates have been estimated from current relief and precipitation, but a more complete evaluation of the controls on erosion rates requires detailed measurements across a range of timescales. Here we report erosion rates in the Taiwan mountains estimated from modern river sediment loads, Holocene river incision and thermochronometry on a million-year scale. Estimated erosion rates within the actively deforming mountains are high ( $3\text{--}6\text{mmyr}^{-1}$ ) on all timescales, but the pattern of erosion has changed over time in response to the migration of localized tectonic deformation. Modern, decadal-scale erosion rates correlate with historical seismicity and storm-driven runoff variability. The highest erosion rates are found where rapid deformation, high storm frequency and weak substrates coincide, despite low topographic relief.*

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11. According to the article, which of the following will not cause higher erosion rates? (A) Rapids and floods. (B) Earthquakes. (C) Typhoons and storms. (D) Human activities.
12. What parameter was not used in this study? (A) River sediment load. (B) Stream power erosion index. (C) Fission track ages. (D) Earthquake activities.
13. Which is not needed in the estimation of erosion rates? (A) River incision. (B) Topographic relief. (C) Rain fall. (D) Structural evolution of the mountains.
14. What is the main idea of this article? (A) Modern technology can now stop erosion from happening. (B) Sediment is produced and mobilized by storm-triggered landslides, but runoff variability will be low when typhoons hit Taiwan. (C) There is a close relationship between erosion, runoff variability and seismicity in the Taiwan orogen. (D) Earthquakes produce sediment by rock mass shattering and landsliding, which is rarely seen in Taiwan.
15. Which factor does not contribute to the erosion rate of Taiwan? (A) Typhoons. (B) Damming. (C) Earthquakes. (D) Uplift.

**Answer questions 16-20 according to abstract of the following article:**

Hilton, R.G., Galy, A., Hovius, N., Chen, M.-C., Horng, M.-J., and Chen, H., 2008. *Nature Geoscience* 1, 759-762.

*The transfer of organic carbon from the terrestrial biosphere to the oceans via erosion and riverine transport constitutes an important component of the global carbon cycle. More than one third of this organic carbon flux comes from sediment-laden rivers that drain the mountains in the western Pacific region. This region is prone to tropical cyclones, but their role in sourcing and transferring vegetation and soil is not well constrained. Here we measure particulate organic carbon load and composition in the LiWu River, Taiwan, during cyclone-triggered floods. We correct for fossil particulate organic carbon using radiocarbon, and find that the concentration of particulate organic carbon from vegetation and soils is positively correlated with water discharge. Floods have been shown to carry large amounts of clastic sediment. Non-fossil particulate organic carbon transported at the same time may be buried offshore under high rates of sediment accumulation. We estimate that on decadal timescales, 77–92% of non-fossil particulate organic carbon eroded from the LiWu catchment is transported during large, cyclone-induced floods. We suggest that tropical cyclones, which affect many forested mountains within the Intertropical Convergence Zone, may provide optimum conditions for the delivery and burial of non-fossil particulate organic carbon in the ocean. This carbon transfer is moderated by the frequency, intensity and duration of tropical cyclones.*

16. Which statement is false? (A) Carbon transfer can be moderated by tropical cyclones. (B) Sediment-laden rivers, especially those drain the mountains in the western Pacific region, play an important role in global carbon cycle. (C) Mountain rivers carry clastic sediment as well as particulate organic carbon to the sea. (D) The total amount of organic carbon, including soils

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and standing biomass, is the only carbon we can find in the ocean.

17. More than one third of terrestrial organic carbon flux was from: (A) Western Indian region. (B) Central Asia. (C) Western Pacific region. (D) Taiwan.
18. River discharge during a typhoon is related to the amount of: (A) clastic sediment. (B) Dissolved oxygen. (C) Particulate organic carbon from soil. (D) Particulate organic carbon for plants, exported by the river.
19. Where is the Intertropical Convergence Zone located on the planet earth? (A) Polar regions. (B) Mid-latitudes. (C) Pacific island chains. (D) Tropical region around the equator.
20. Where is LiWu River? (A) Southern coast of China. (B) Southern coast of Japan. (C) East coast of Taiwan. (D) West coast of Taiwan.

**II. 基本字彙測驗：寫出下列各英文名詞的中文(每題 2 分，共 10 分)。**

1. Fossil fuel      2. Ocean acidification      3. Lithosphere      4. Kuroshio  
5. Primary production

**III. 基本字彙測驗：寫出下列各中文名詞的英文 (每題 2 分，共 10 分)。**

1. 碳循環      2. 北極震盪      3. 海嘯      4. 光合作用      5. 溶解氧

**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 (共 20 分)。**

1. 自工業革命後大氣中的二氧化碳增加所導致的溫室效應，造成全球暖化的現象。此種現象使得地球的大氣層和海洋增溫，造成南、北極冰架和高山冰川的融解，這將成為全球性的環境災難。
2. 海水的密度受到壓力、水溫和鹽度的控制，因此在有陸地淡水注入之近海區域，海水的密度較低。在冬季，因氣溫下降，使得海洋表層海水的密度增大。