國立中山大學八十八學年度碩博士班招生考試試題

科　目：生理学　（海資甲選考）

問答題

1. 詳述人体失血後的生理反應機轉。(30分)
2. 何謂人体中電的訊息 (electrical signal) 的傳遞及化学性訊息 (chemical signal) 的傳遞，請举例說明。(20分)
   並比較兩者在生理功能上各有何優缺點。(15分)
3. 何謂生理時鐘 (biological clock)？(5分)
   其節律產生之機制为何？(10分)
   請以神经解剖 (neuroanatomy) 觀點闡述人体有關褪黑素为主節律之生理機轉。(10分)
4. 水腫 (edema) 產生的机制為何？(10分)

1. (10%) Explain the following terms.

   (a) glucogenic amino acid
   (b) oxidative phosphorylation
   (c) zymogen
   (d) anabolism
   (e) energy charge

2. (10%) The oxygen dissociation curves of myoglobin and hemoglobin are quite different. Describe the characters of these two curve as much as you know . Explain why they behave in different manners.

3. (5%) The nature of polypeptide chains can be described in terms of primary , secondary , tertiary and quaternary structures . Explain these four terms.

4. (10%) If a bacterial culture is carrying out alcoholic fermentation of ^{14}C-labeled glucose , in which position(s) of the glucose molecule would the radioactive ^{14}C atoms have to be located in order to ensure that the CO_2 produced during the fermentation process is labeled with ^{14}C ? Show your work clearly.

5. (10%) What is photorespiration ? How does it limit the efficiency of biomass production of C_3 plants ?

6. (5%) The lipid bilayer of the cell membrane prevents the rapid escape of ions as K^+ , Cl^- and Mg^{2+}, from cells. Why ?

7. (20%) In a molecular biology lab, you will hear frequently about the DNA sequencing in which the base ordinal in an interesting DNA were determined. Please list its applications after knowing the DNA sequence.

8. (30%) Please explain the meanings of following words used in molecular biology:
   (a) Southern blot
   (b) Northern blot
   (c) Western blot
   (d) Finger printing
   (e) Foot printing
   (f) *In situ* hybridization
   (g) PCR
   (h) RT-PCR
   (i) Primer
   (j) Promoter

國立中山大學八十八學年度碩博士班招生考試試題

科 目：普通生物学（海资系硕士班甲组選考） 共 1 頁 第 1 頁

1. What osmoregulatory adaptations are found in freshwater organisms which permit them to live in hypoosmotic fresh water? In sharks which permit them to survive in the marine environment? In marine bony fishes? (20分)

2. What are some important differences between chemiosmosis in oxidative phosphorylation and chemiosmosis in photophosphorylation? (20分)

3. Why do the assumptions of the logistic model not apply to all population? What is the Allee effect? (10分)

4. 由低等到高等動物其細胞獲得充分氧氣的演化過程，詳述之 (20分)

5. 闡述"体溫"的意義。(5分)
以能量觀点闡述生物由單細胞体到多細胞体的演化意義。(15分)

6. 詳述細胞分裂 (cell division) 的控制機制。(10分)

國立中山大學八十八學年度碩博士班招生考試試題

科　目：生態學（海資甲選考）　　共 1 頁 第　頁

一. 解釋名詞(30%) (每題3分)

1. Allopatric speciation
2. Commensalism
3. Biological magnification
4. Adaptive radiation
5. Vant Hoff's law
6. Pycnocline
7. Compensation depth
8. Langmuir convention cell
9. Hydrothermal vent
10. *Anguilla japanica*

二.簡答題（請在20個字以內簡要回答）(15 分)

1. 一般而言，能量在不同營養階層傳遞之生態效率大約是多少？(2分)
2. 生物群聚演變至巔鋒狀態時，其Production/Respiration之比值約等於多少？(2分)
3. 請比較溫血動物和冷血動物何者之R(respiration)/A(assimilation)比值較大？(2分)
4. 所謂酸雨(Acid rain)一般是指pH值小於多少之雨水？(2分)
5. 國內至目前共設立了幾個國家公園？幾個自然保留區？(2分)
6. 請比較海洋浮游植物和陸生植物何者之turnover rate 較大？(2分)
7. 一個好的生態模式必須具備哪三個要件(three dimension)？(3分)

三. 問答題 (55%)

1.最近流行飼養水母，您知道他們所飼養的水母是什麼種類嗎？請描述一般水母的生態習性或特徵爲何？(10 分)
2.生物多樣性(Biodiversity)的定義爲何？目前一般認爲造成生物多樣性消失的原因有哪些？(10 分)
3.長江三峽水壩的建造是近代人類史上最大的水利工程，請問如此重大的工程建設對長江流域之生態環境及東海海洋生物資源可能會有什麼樣的衝擊？(10分)
4.請說明流經臺灣沿海的 " Kuroshio Current " 對臺灣沿近海的海洋生物資源有何重要性？ (10分)
5. 海洋往往是人們做爲各種家庭和工廠污水及廢棄物之最終去處。請論述臺灣在近三四十年來高度的工業發展及快速的人口成長過程中，對臺灣沿近海域引入了那些污染源？ 這些污染源對臺灣沿近海域之海洋環境及資源有什麼樣的潛在危害，並可能危及臺灣人民的健康及福祉？我們又該如何來防患未然？(15分)

國立中山大學八十八學年度碩博士班招生考試試題

科　目：生物統計學（海資甲選考）　　共 4 頁 第 1 頁

10% 一、某環保人員想檢查愛河水之水質，逢機自愛河中取 49 個水樣，得其溶氧平均值 $\bar{y}$=5.0 ppm 及 s=0.70 ppm，請問此平均溶氧是否比去年同地點之平均值 5.2 ppm 來得低?(α=0.05)

20% 二、有一研究人員計算樣品之平均值為 10，並求得兩個平均值之可信間距 (Confidence interval)分別為 9-11 及 8.5-11.5。請問

(a) 如果以上兩個可信間距可能各屬於 95%與 99%可信間距之一，請問那一個較有可能屬於 95%可信間距?____(1)____;並說明理由:____(2)____。

(b)如果以上兩個可信間距為由兩個具不同樣品個數(sample size)之樣品計算而得，請問那一個可信間距是由具較大 sample size 的樣品計算得來的?____(3)____;並說明理由:____(4)____。

32% 三、以下 a -d 各小題，請

（1）寫出其統計模式(Statistical model)並說明模式中各項變數。

（2）列出其變方分析(Anaiysis of variance, ANOVA)表中之變因項目(Source of variation)及自由度(degree of freedom)，自由度請寫出阿拉伯數目（※註：不需實際運算）

a. 有一環境學家，想研究高雄港愛河細菌分布在上、中、下游三區是否相同，今在各區逢機各取 6 個樣品，計數其中細菌數如下：

上游	中游	下游
45	68	65
38	59	55
35	79	69
36	65	58
57	60	56
42	52	68
39	71	62

b. 海洋地質學者研究岩心(core)中土壤之酸鹼度(pH)，在岩心之上、中、下層是否差異。今取得 6 根岩心，記錄各根岩心 pH 值如下：

岩心	上層	中層	下層
1	7.5	7.6	7.2
2	7.2	7.1	6.7
3	7.3	7.2	7.0
4	7.5	7.4	7.0
5	7.7	7.7	7.0
6	7.6	7.7	6.9

c. 一實驗探討魚冰藏 7 天後之品質，使用 10 隻同品種、體形大小相似且同時捕獲之魚隻進行之。其中 2 隻魚被捕後立刻冰藏；2 隻魚是 3 小時後冰藏；被捕 6 小時、9 小時、12 小時分別亦各有 2 隻被冰藏，冰藏 7 天後檢視魚品質，魚品質以 10 分為滿分計，想知道被捕後、冰藏前之時間長短是否影響魚品質，及預測魚被捕 10 小時後再冰藏天之品質。以下為數據：

品質	8.5	8.4	7.9	8.1	7.8	7.6	7.3	7.0	6.8	6.7
時間	0	0	3	3	6	6	9	9	12	12

d. 測試三種鍛練肌肉的方法，效果是否相同，但考慮訓練前肌肉之狀況一併記錄以為分析用，以下為肌肉狀況在訓練前及訓練後發展之分數。每個訓練方法分別逢機取 5 個人進行測試：

方法一		方法二		方法三	
前	後	前	後	前	後
102	17	117	20	111	21
124	29	133	33	104	20
115	19	106	15	117	22
136	32	120	28	130	25
121	21	128	26	126	11

16% 四、以下為比較控制組海水(SW)及添加不同濃度NH_4^+-N下，培養不同飢餓狀態後(well fed, lightly fed, starved for 30 days)之海葵(Aiptasia pallida, 其體內共生藻(Zooxanthellae)在黑暗中之固碳隨時間之變化，請由下圖簡單扼要說明實驗。

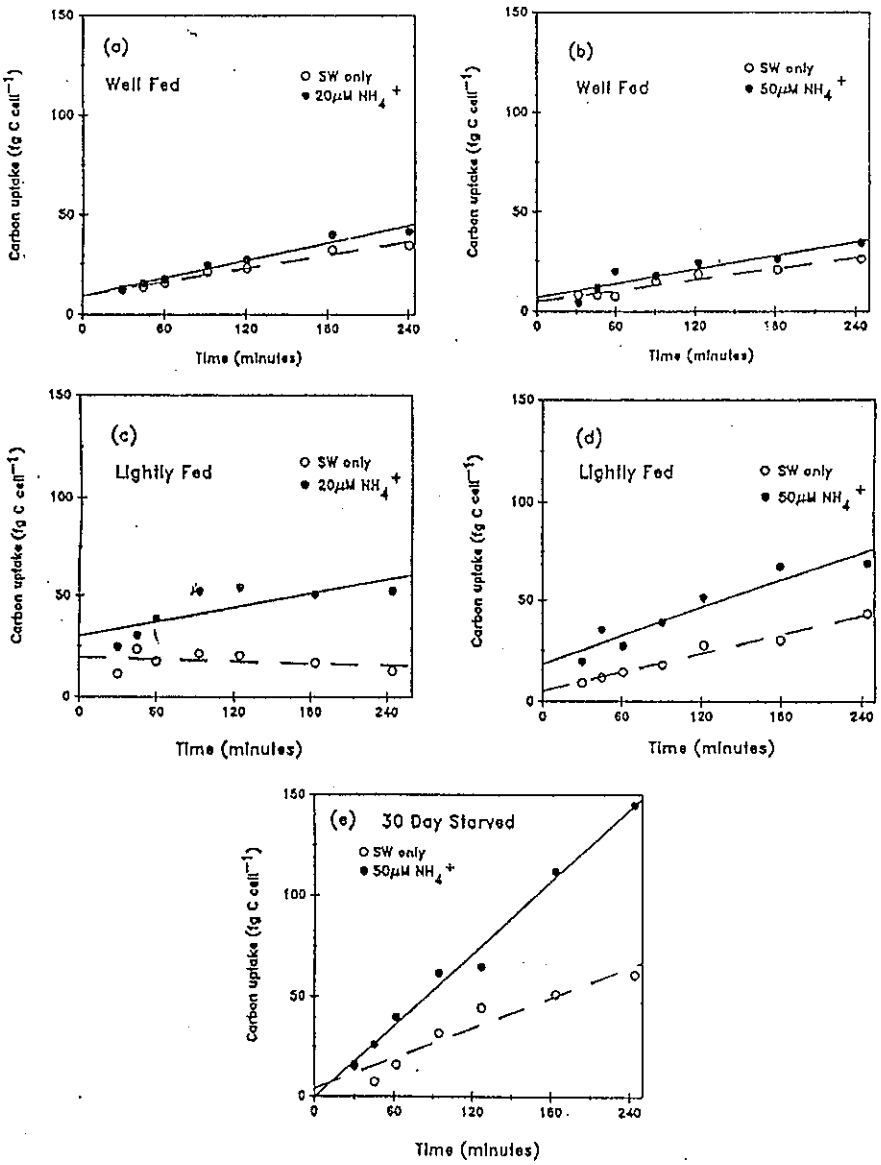
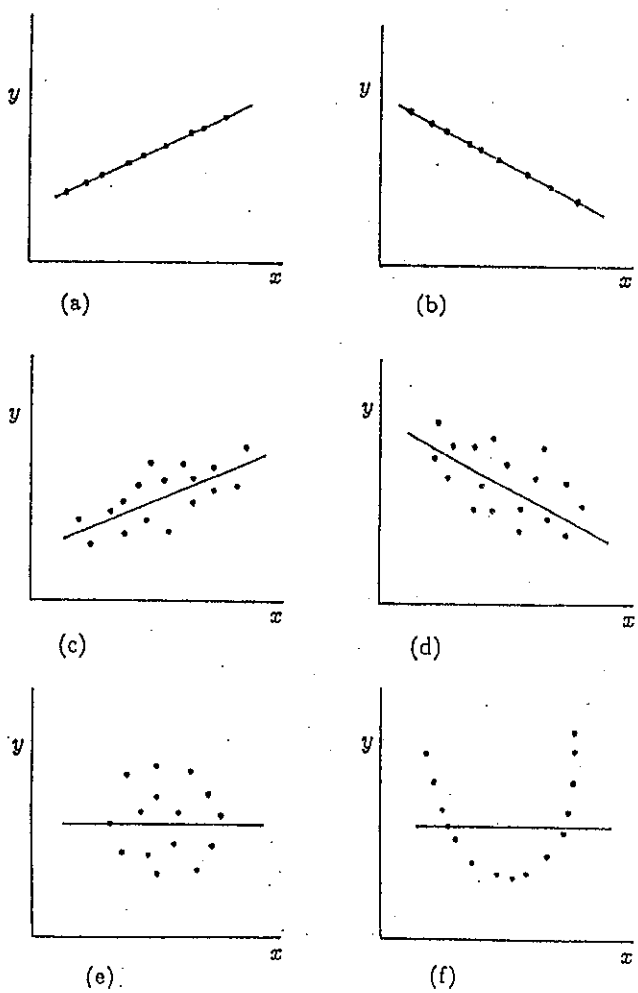


Fig. 1. Time-course of dark C fixation by zooxanthellae isolated from laboratory populations of *Aiptasia pallida*. Least-squares linear regression lines are shown for each plot.

10% 五、 在逢機區集設計(Randomized Block Design)中假設試驗(treatment)與區集(block)間無interaction；請繪圖並用圖說明何謂“interaction”

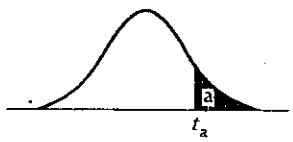
12% 六、下圖 (a)-(f) 請填入適當之相關係數(r)值。

(甲) r=+1
(乙) r=-1
(丙) r=0
(丁) 0<r<1
(戊) -1<r<0



附表：

Table Percentage points of the t distribution



df	a = .10	a = .05	a = .025	a = .010	a = .005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.787
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
inf.	1.282	1.645	1.960	2.326	2.576

From "Table of Percentage Points of the t-distribution." Computed by Maxine Merrington, *Biometrika*, Vol. 32 (1941), p. 300. Reproduced by permission of the *Biometrika* Trustees.

國立中山大學八十八學年度碩博士班招生考試試題

科　目：微積分（海資所乙組選考）

請解下列所有問題，並請注意，若祇給答案，而無合理之計算過程或說明，將不給分!!

(1) 計算極限：(a) $\lim_{x\to 0} \dfrac{\sin^{-1}x - x^2\cos\frac{1}{x}}{x}$ (5分)　(b) $\lim_{x\to 0^+} x(\ln x)^3$ (5分)

(2) 計算不定積分：(a) $\int \sec^3 x\,dx$ (5分)　(b) $\int x\sqrt{x^4+2x^2+2}\,dx$ (5分)

(3) 判別瑕積分 $\int_0^2 \dfrac{\sqrt{x}\cos x}{e^x-1}\,dx$ 收斂或發散. (10分)

(4) 請問曲線 $y=\tan x$, $(-\frac{\pi}{2}<x<\frac{\pi}{2})$, 與直線 $y=2x$ 恰有幾個交點? (10分)

(5) 設 $f(x)=\sin x$, $0\le x\le \pi$, 且令 Ω 為 f 的圖形與 x 軸所圍成的區域.

(a) 求 Ω 的面積. (5分)

(b) 求 Ω 的形心 (centroid) 的坐標. (5分)

(c) 求 Ω 繞直線 $y=x$ 旋轉一周所形成之立體的體積. (5分)

(6) 設函數 $f: \mathbb{R} \longrightarrow \mathbb{R}$ 定義為 $f(x) = -2 + \int_1^x \dfrac{dt}{\sqrt[3]{t^4+t^2+1}}$，其中 $\mathbb{R}$ 表示實數系.

(a) 證明 f 具有反函數. (5分)

(b) 令 g 表示 f 的反函數，求與 g 的圖形相切於 $(-2, g(-2))$ 的切線方程式. (5分)

(c) 判別 $\lim_{x\to\infty} f(x)$ 是否存在? (5分)

(7) 對於每一個正整數 n，令 $a_n = 1-\cos\frac{1}{n}$，求冪級數

$$\sum_{n=1}^{\infty} a_n (x+1)^n$$

的收斂區間. (15分)

(8) 令 $f(x)=\sqrt{1+x}$, $x>-1$

(a) 求 f 在 $x=0$ 展開的泰勒級數. (8分)

(b) 求 $\sqrt{1.01}$ 的近似值到小數點後第5位. (7分)

國立中山大學八十八學年度碩士班招生考試試題

科 目：礦物學（海資乙選考）

問答與計算題

一、(15%)

(a) 何謂对称（symmetry）？

(b) 礦物學中有那些对称性質（或对称元素）？

(c) 那一种对称性質是任何晶体所必備的？

二、(15%)

試描繪並說明屬於等軸（isometric）、正方（tetragonal）、和斜方（orthorhombic）三晶系之布拉維晶格（Bravais lattices）.

三、(15%)

試列舉三种非自然元素態之經濟礦物，並且 (a) 說明其化學成份或寫出其化學式，(b) 說明其產狀（occurrence），(c) 說明其經濟用途.

四、(10%)

若有兩晶体之点群对称分別為 (a) $\frac{2}{m}$ 和 (b) $\frac{2}{m}\frac{2}{m}\frac{2}{m}$，試利用簡繪之赤平投影（stereo projection）圖就此二晶体之假想晶面作对称運作，在圖上標出普通晶形（general form）之晶面極（face pole）位置，並寫出該晶形和所屬晶系名称.

五、(10%)

什麼是條紋長石（perthite）？說明其形成的原因和過程.

六、(10%)

鑽石和石墨均為同一元素所組成，為什麼具有非常不同的物理性質，試說明之（請配合其各具有之物理性質詳細說明）.

七、(10%)

有一斜輝石(clinopyroxene)晶体，已知其化學成份為：

		原子量：	
CaO = 22.73 %	(重量百分比)	Ca	= 40.08
MgO = 13.28 %		Mg	= 24.31
FeO = 8.00 %		Fe	= 55.84
TiO_2 = 1.52 %		Ti	= 47.90
Al_2O_3 = 4.24 %		Al	= 26.98
SiO_2 = 49.15 %		Si	= 28.08
		O	= 16.00

試計算此斜輝石之化學式(需寫出計算過程)。

八、(15%)

下面二圖為某一种礦物之結構圖(兩种表示法)，大球為陰離子，小球為陽離子，試回答下列問題。

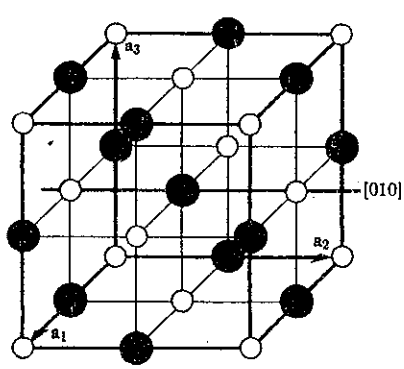
(a) 設陽離子為A，陰離子為B，利用配位數觀念導出此礦物之化學式。

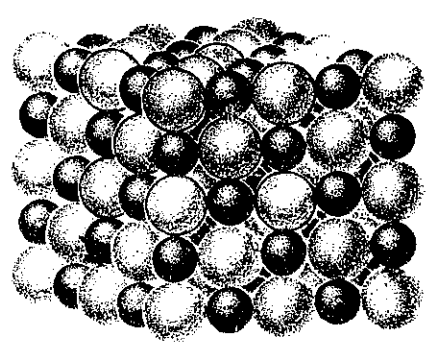
(b) 此礦物之晶胞中(unit cell)包含幾個A和B離子？

(c) A和B分別以什麼方式堆積排列？

(d) 列出此礦物所具有之对称性質(包括对称元素和其數量)。

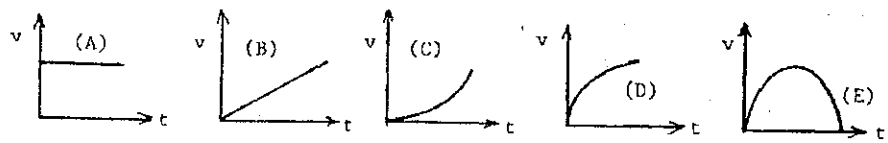
(e) 此种結構通常被稱之為什麼結構？



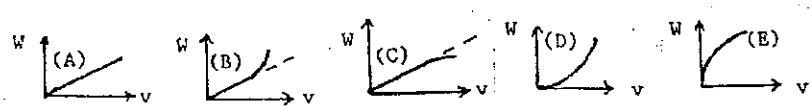


一，選擇題部份，共有八題，每題 5 分。將答案寫在答案卷上。

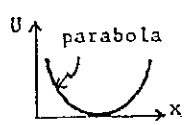
(1) An object is dropped from rest. Which of the following graphs correctly represents its motion?

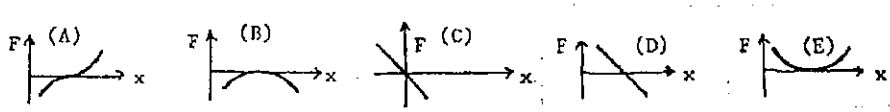


(2) A particle is initially at rest on a horizontal frictionless table. It is acted upon by a constant horizontal force F. Which of the following five graphs is a correct plot of work W as a function of particle speed v?

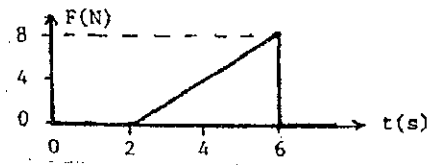


(3) The graph at the right shows the potential energy U(x) for a particle moving on the x axis. Which of the following five graphs correctly gives the force F exerted on the particle?



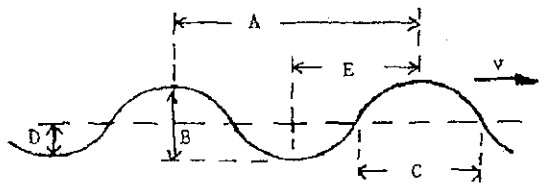


(4) A 2 kg object is acted upon by a single force in the x-direction in a manner described by the graph below. The momentum acquired by the object is:

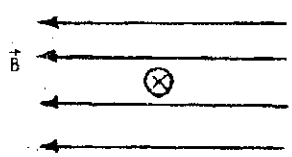


a. 16 N·s
b. 30 N·s
c. 32 N·s
d. 40 N·s
e. 48 N·s

(5) A sinusoidal wave is traveling toward the right as shown. Which letter correctly labels the amplitude of the wave?

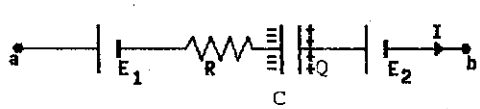


(6) The figure shows a uniform magnetic field **B** directed to the left and a wire carrying a current into the page. The magnetic force acting on the wire is:



a. toward the top of the page
b. toward the bottom of the page
c. toward the left
d. toward the right
e. zero

(7) The figure shows part of an electric circuit。If R = 3.0 kΩ, C = 6.0 nF, E_1 = 10.0 V, Q = 18 nC, E_2 = 6.0 V, and I = 5.0 mA, What is the potential difference $V_a - V_b$?



a. –13 V
b. 28 V
c. 13 V
d. –28 V
e. 0 V

(8) A capacitor in a single-loop RC circuit is charged to 85% of its final potential difference in 2.4 s. What is the time constant for this circuit?

a. 1.5 s b. 1.3 s c. 1.7 s d. 1.9 s e. 2.1 s

二，計算題部份，共六題，每題 10 分

1，In the electric circuit shown in Fig. 1, If E = 8.0 V, at what rate is the emf E providing energy to the circuit?

2，The coil shown in the Fig. 2 has 2 turns, a cross-sectional area of 0.20 m^2, and a field (parallel to the axis of the coil) with a magnitude given by $B = (4 + 3t^2)$ T, where t is in s. What is the potential difference, $V_A - V_C$, at t = 3.0 s.

3，In the Fig. 3, If a = 1.0 cm, b = 3.0 cm, and I = 30 A, What is the magnitude of the magnetic field at point P?

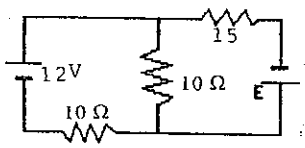


Fig. 1

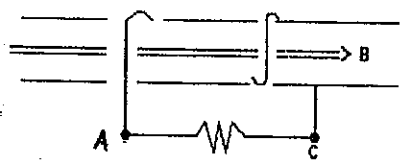


Fig. 2

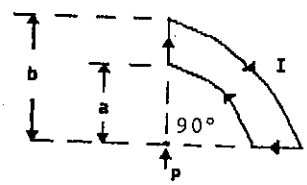


Fig. 3

4，Helium-neon laser light ($\lambda = 6.33 \times 10^{-7}$ m) is sent thru a 0.3 mm-wide single slit. What is the wide of the central maximum on a screen 1 m in back of the slit?

5，The fresh water behind a reservoir dam is 15 m deep. A horizontal pipe 4.0 cm in diameter passes through the dam 6.0 m below the water surface, as shown in Fig. 4. A plug secures the pipe opening. (a) Find the friction force between plug and pipe wall. (b) The plug is removed. What volume of water flows out of the pipe in 3.0 s?

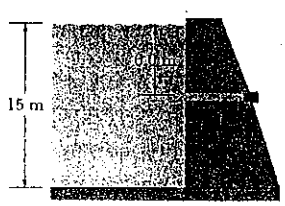


Fig. 4

6、A French submarine and a U. S. submarine move head–on during maneuvers in motionless water in the North Atlantic (Fig. 5). The French sub moves at 50.0 km/h, and the U. S. sub at 70.0 km/h. The French sub sends out a sonar signal at 1000 Hz. Sonar waves travel at 5470 km/h. (a) What is the signal's frequency as detected by the U. S. sub? (b) What frequency is detected by the French sub in the signal reflected back to it by the U. S. sub?

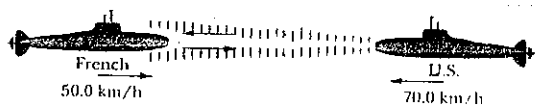


Fig. 5

國立中山大學八十八學年度碩博士班招生考試試題

科　目：海洋物理學(海洋資源研究所乙組選考)　　

1.說明赤道流場的概況(提示： NEC,NECC,SEC,EUC)
它和赤道風場有關連嗎？(10 分)

2.湧升流(upwelling)通常發生在沿岸及赤道地區，成因是什麼？
有何重要性？(10 分)

3.地衡流(geostrophic current)是什麼？大洋的表層環流一般可視為地衡流，除了直接觀測洋流之外，最常用的方法便是用地衡流的公式來推算洋流，請問這個方法需要用到哪些資料，怎麼推算的？(10 分)

4.西方邊界流怎麼形成的？在南北大西洋及南北太平洋分別稱為什麼名字？從流速、寬度、深度、溫度、湧升流和生產力等方面來說明西方邊界流與東方邊界流的不同. (10 分)

5.海嘯波如何形成的？它到達大洋和海岸時有何不同特性？屬於長波(淺水波)或短波(深水波)？為什麼？(10 分)

6.「無風不起浪」，請問波浪的大小和成長與風有何關連？
海面上常見的波浪其週期和波高大概是多少？湧浪(swell)又是什麼東西？(10 分)

7.潮汐的形成和月亮及太陽有關，為何在很多地方(如台灣)一天有兩次 high tide 及兩次 low tide ？為何在農曆初一(或十五)及上弦月(或下弦月)時潮差又不太一樣？(10 分)

解釋名詞：(每小題 5 分)

1.sound channel	4.internal wave
2.thermocline	5.T-S plot
3.Coriolis effect	6.中洋脊(mid-ocean ridge)

國立中山大學八十八學年度碩士班招生考試試題

科 目：普通地質學（海資乙選考）

一. 解釋名詞（每小題 3 分，共 30 分）

1. Sea-floor magnetic anomalies
2. Regional metamorphism
3. Graded bedding
4. Ore deposit
5. Subduction zone
6. Placer deposit
7. Magma
8. Ophiolite
9. Evaporite
10. Joint

二. 問答題（每小題 10 分，共 70 分）

1. 回答以下有關於石英（quartz）之問題：
   a) 石英含有什麼元素？試寫出其化學式。
   b) 石英具有何种矽酸鹽構造？
   c) 試區別並說明以下四個名詞：
      silica, silicon, silicate, silica tetrahedron.

2. 試說明以下沈積物是經由何种風化作用而形成：
   a) 直徑數公尺之大塊礫石
   b) 直徑約 1 mm 大小之砂粒
   c) 直徑僅數微米大小之黏土顆粒

3. 利用那些沈積構造可以判斷沈積岩層的上下層序？試說明之。

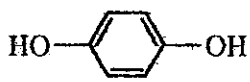
4. 何謂結晶分異作用（fractional crystallization）？其與礦床的形成有什麼關係？試舉一种屬此類型之金屬礦為例。

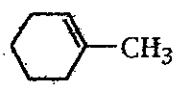
5. 地球半徑約 6400 km，人類目前利用鑽探只能達到 10 km 深（陸地上）和 2 km 深（海底下），試問我們要利用那些方法或從什麼訊息來研究和瞭解地球內部的構造和性質？

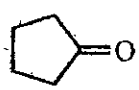
6. 如果你要在一個陡峭的山壁旁買或蓋一幢房子，有那些地質條件是你應該去注意和檢查的？

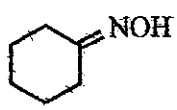
7. 在1915年德國科學家韋格納已根據許多資料提出大陸漂移說，何以大陸漂移說一直到1960～1970年代才廣為被接受，並形成一個「板塊構造學說」（Plate tectonics）？

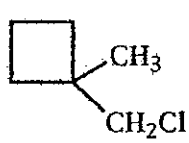
A. Complete the following reactions. (30%)

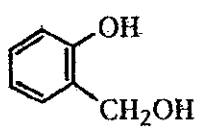
(a)  $\xrightarrow{FeCl_3\ solution}$?

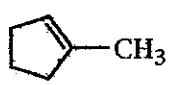
(b)  $\xrightarrow{O_3}$?

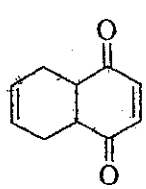
(c)  + $C_6H_5CH{=}P(C_6H_5)_3$ ⟶ ?

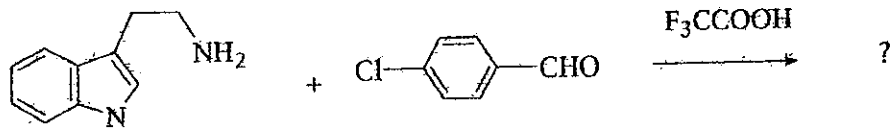
(d)  $\xrightarrow[2.\ H_2O]{1.\ PCl_5}$?

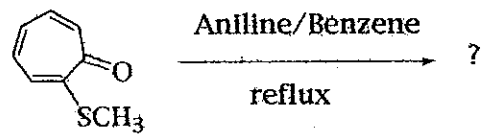
(e)  $\xrightarrow[H_2O]{AgNO_3}$?

(f)  $\xrightarrow{CH_2N_2}$?

(g)  $\xrightarrow[2.\ H_2O_2,\ OH^-]{1.\ B_2H_6}$?

(h)  $\xrightarrow[100\,^\circ C]{1,3\text{-butadiene}}$?

(i) 

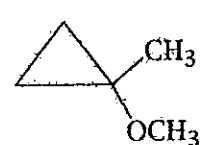
(j) 

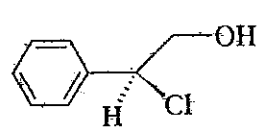
B. Give a specific example of the following name reactions. (20%)

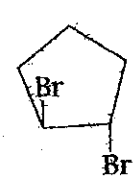
1. Pinacol rearrangement
2. Aldol condensation
3. Mannich reaction
4. Hofmann degradation
5. Cope elimination

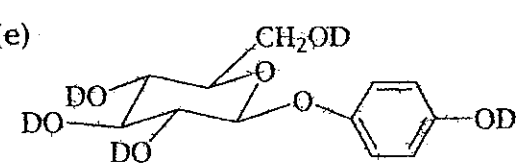
C. How many magnetically different kinds of protons are there in each of the following compounds ? (10%)

(a) $CH_3OCH_2CH_2CH_2OCH_3$

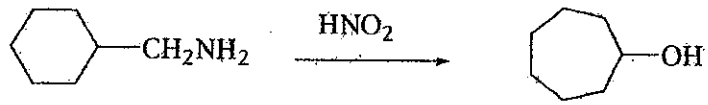
(b) 

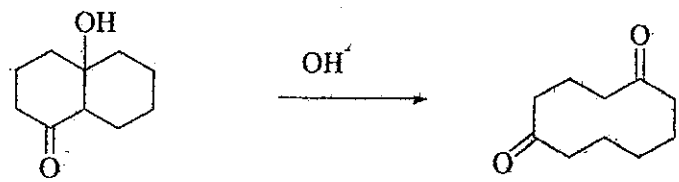
(c) 

(d) 

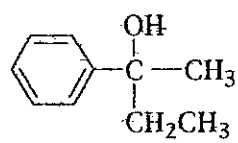
(e) 

D. Suggest the mechanisms for the following reactions. (10%)

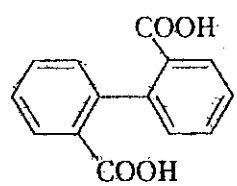
(a) 

(b) 

E. Outline practical laboratory synthesis of the following compounds. (10%)

(a) 

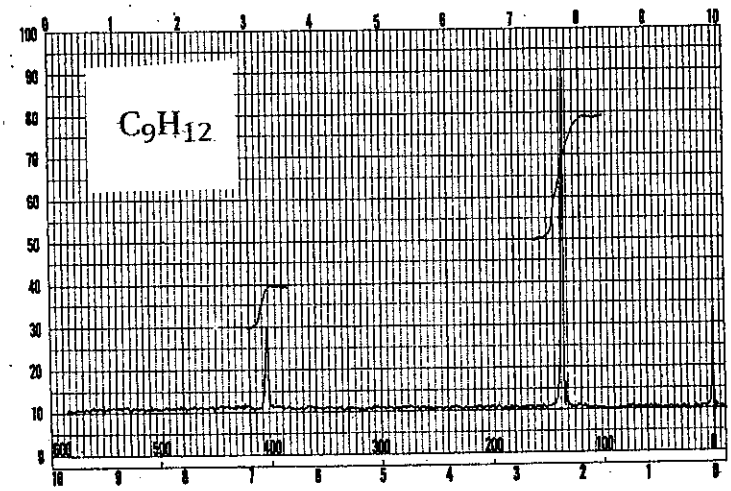
from benzene and two-carbon compounds

(b) 

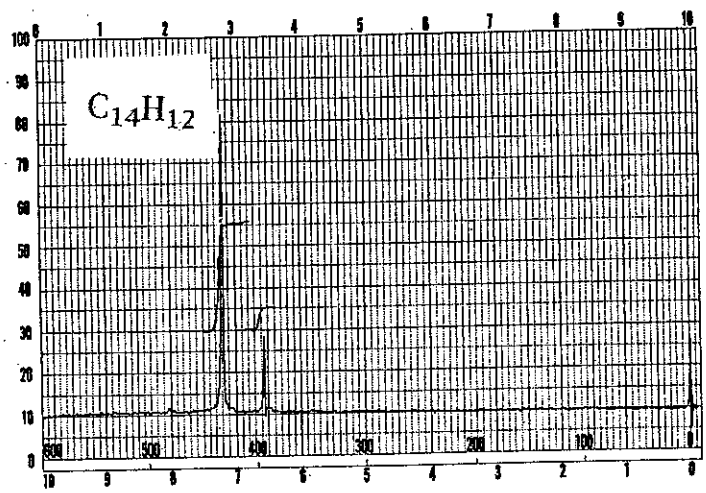
from toluene

F. Determine the following chemical structures. (20%)

1) 10%



2) 10%



國立中山大學八十八學年度碩博士班招生考試試題

科 目：分析化學 (海資丙組)

1. (20%) Define any **four** terms of the following list.
(Note: **not** "translation" of the terms from English to Chinese.)

null hypothesis	indeterminate errors	standard reference material
internal standard	leveling solvents	retention time
titration error	amphiprotic solvents	auxiliary oxidizing reagents
buffer capacity	blank solutions	auxiliary complexing agent
standardization	confidence level	EDTA displacement titration
relative supersaturation	differentiating solvents	liquid junction potential
electrical double layer of a colloid		homogeneous precipitation

2. (20%) Describe (1) the principles (or mechanism) of any **two** of the following devices, and (2) the purpose of using the two devices. (You may use a drawing to illustrate your description, but a drawing without explanation will not earn any credit.)

PMT	photodiode array
charge-coupled device (CCD)	thermocouple
interference filters	Echellette grating monochromators
Michelson interferometer	electrothermal atomizers
potentiostat	galvanostat
time-of-flight mass analyzers	

3. (20%) Write down the mathematical form of **two** of the following equations and describe the meaning and application of the two equations.

Beer's law	Debye-Hückel equation	van Deemter equation
Nernst equation	Henderson-Hasselbalch equation	

4. (10%) Write the mass-balance expressions for a solution that is
(1) 0.1 M in H_3PO_4
(2) saturated with CaF_2.

5. (10%) Write down the correct procedures of preparation
of a pH 4.7 buffer solution with tartaric acid concentration of 1.0 M.
(note: K_{a1} and K_{a2} for tartaric acid are 9.20×10^{-4} and 4.31×10^{-5}, respectively.)
(You need to describe every preparation step and your calculations in detail.)

6. (20%) Calculate the pZn for solutions prepared by adding 20.0, 25.0, and 30.0 mL of 0.0100 M EDTA to 50.0 mL of 0.00500 Zn^{2+}. Assume that both the Zn^{2+} and EDTA solutions are 0.100 in NH_3 and 0.175 M in NH_4Cl to provide a constant pH of 9.0.
(note:
1. The stepwise formation constants for the four zinc complexes with ammonia are $K_1 = 1.62 \times 10^2$, $K_1K_2 = 3.16 \times 10^4$, $K_1K_2K_3 = 7.24 \times 10^6$, and $K_1K_2K_3K_4 = 7.76 \times 10^8$.
2. $K_{ZnY} = 3.2 \times 10^{16}$
3. $\alpha_4 = 5.2 \times 10^2$ at pH 9)