

問答題

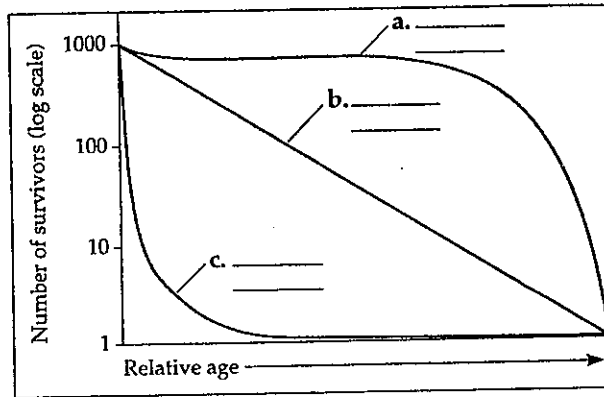
1. What hypotheses have been proposed as possible explanations for the high diversity of tropical communities and the existence of latitudinal gradients in species diversity? Why do these hypotheses not apply to marine benthic communities? (15%)
2. How does the structure of the juxtamedullary nephron enhance water conservation in the kidney of a mammal? (15%)
3. What is the difference between intracellular and extracellular digestion? Why must intracellular digestion be sequestered in food vacuole? (10%)
4. What is a gastrovascular cavity? Why are extracellular digestive cavities advantageous? (10%)
5. 詳述動物「神經系統」的演進。(25分)
6. 詳述內分泌系統在動物體的功能及其作用機轉。(25分)

1. 選擇題 (30 %, 單選, 答對得三分, 答錯倒扣一分)

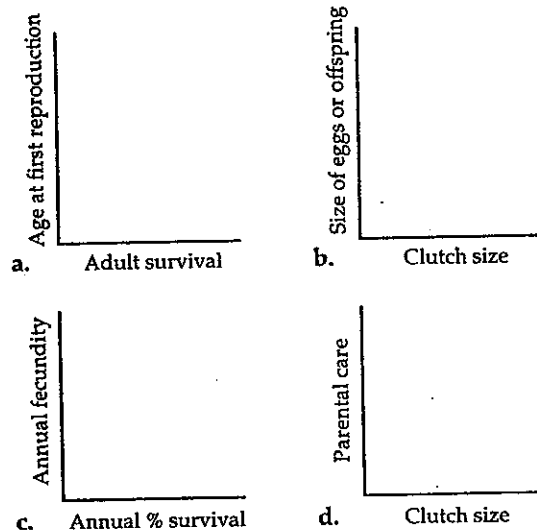
- _____ 1). Which level of ecology considers energy flow and chemical cycling? (A) community (B) ecosystem (C) organism (D) population.
- _____ 2). Upwelling in the ocean (A) are locations of reef communities. (B) occur over deep-sea hydrothermal vents. (C) are responsible for ocean currents. (D) bring nutrient-rich water to the surface.
- _____ 3). When one species was removed from a tidepool. The species richness became significantly reduced. The removed species was probably (A) a strong competitor. (B) a potent parasite. (C) a resource partitioner. (D) a keystone predator.
- _____ 4). Phytoplankton are the basis of the food chain in (A) wetlands. (B) the oceanic pelagic biome. (C) rocky intertidal zones. (D) deep-sea thermal vents.
- _____ 5). Where are "red tide" most likely to occur? (A) headwaters of a stream (B) downstream area of a river (C) open ocean (D) intertidal zone of an ocean.
- _____ 6). The species richness of a community refers to (A) the relative numbers of individuals in each species. (B) the number of different species found in a community. (C) the feeding relationships or trophic structure within the community. (D) the ability to persist through disturbances.
- _____ 7). In a mark-recapture study of a sea bream population, 400 fish were captured, marked, and released. In a second capture, 100 fish were captured; 2 of these were marked. What is the estimated number of individuals in the sea bream populations? (A) 800 (B) 2000 (C) 20000 (D) 40000
- _____ 9). The concept of trophic structure of a community emphasizes the (A) prevalent form of vegetation. (B) effects of coevolution. (C) feeding relationships within a community. (D) species richness of the community.
- _____ 10). Which of these ecosystem has the lowest primary productivity per square meter? (A) a salt marsh (B) an open ocean (C) a coral reef (D) a grassland

2. 填圖題 (20%)

1). Identify the types of survivorship curves shown below and give examples of groups that exhibit each curve. (10%)



2). Fecundity, mortality, age at first reproduction, clutch size, and parental investment are usually interrelated. On the following graphs, sketch the relationship you would predict between the two variables. (10%)



3. 問答題 (50%)

- 1). Please give a concise comparison of energy flow in "pelagic ecosystem" and "hydrothermal vent" ?
- 2). How the "global warming" happen ? What we can do to prevent it getting worse ?
- 3). What is the "Ladder of migration" ? How important is it to the marine ecosystem?
- 4). Please give the definition and examples to r-selected and K-selected species ?
- 5). Around the Taiwanese coastal area how many types of marine ecological environment can be found ? Please describe the major species composition in each environment ?

I. 一研究想瞭解冰藏對魚肉品質的影響。選取同一時候捕獲的10尾體型大小類似的同一種魚進行試驗。其中5尾在捕獲後立即冰藏，而後在捕獲後3小時、6小時、9小時及12小時，分別各取2尾冰藏。魚肉品質在冰藏7天後評估。以10分為滿分其評分結果如下：

貯藏時間 (小時)				
0	3	6	9	12
8.5	7.9	7.8	7.3	6.8
8.4	8.1	7.6	7.0	6.7

將此結果進行分析，分別列表一 (ANOVA) 及表二 (ANOR) 如下：

ANOVA (表一)

Source of Variation	SS	df	MS	F
Treatment	3.634	4	d	f
Error	a	b	e	
Total	3.729	c		

ANOR (表二)

Source of Variation	SS	df	MS	F
Regression	3.6125	i	l	n
Error	j	k	m	
Total	h	g		

(28%) (1) 於答案卷上，請分別寫出表一中之 a, b, c, d, e, f 之數值，及表二中之 j, k, i, l, m, n 數值 (每個空格2分)

(10%) (2) 上述兩分析方法 (表一及表二) 所得結果，請進行測試 (用 $\alpha=0.05$ ，並參考所附 F-表)，並下結論

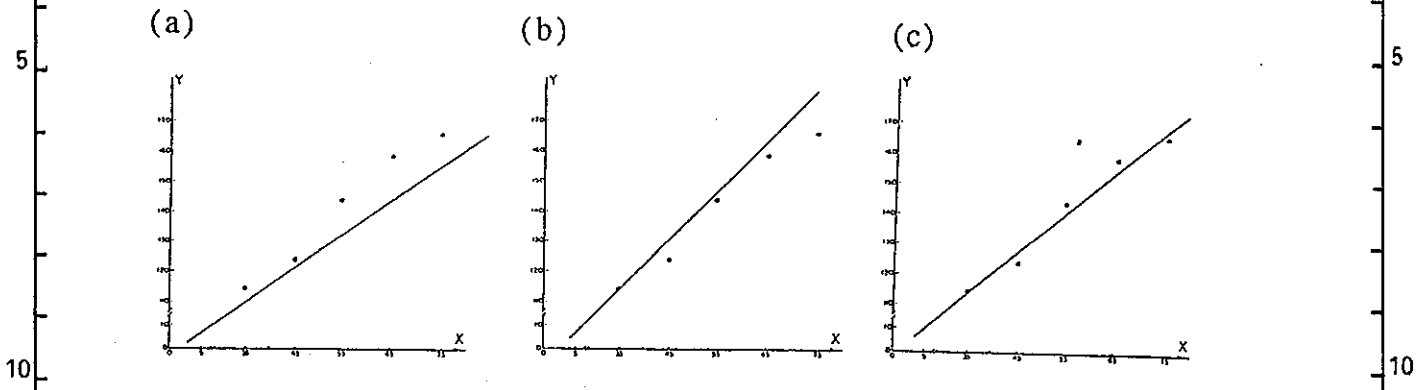
(10%) (3) 比較上述兩分析方法之相似及相異。

(橫書式)

國立中山大學八十七學年度碩博士班招生考試試題

科目：生物統計學 (海洋資源新甲組選考) 共4頁 第2頁

II (10%) 下圖資料分別由三位學生以最小平方和法計算 $\hat{Y} = \beta_0 + \beta_1 X$, 分別得出
(a) $\hat{Y} = 70.2 + 1.12X$, (b) $\hat{Y} = 60.8 + 1.54X$, (c) $\hat{Y} = 65.1 + 1.38X$, 請
判斷何者較合理, 並請說明者=者不合理(計算錯誤)之理由。



III (20%) 有一研究想探討海洋放流管排放工業廢水至沿岸海域時, 對沿岸
養殖之牡蠣體內蓄積重金屬(如銅)的影響。請(a)設計一個
實驗, 詳述實驗設計, 分析項目, 採樣方法, 並(b)說明資料分析
方法(將原始數據, 及統計分析之結果, 均以"表列"方式表達, 註:
不需實際數據)及使用之數學模式。

(橫書式)

國立中山大學八十七學年度碩博士班招生考試試題

科目：生物統計學 (海洋資源系 甲組 選考) 共4頁 第3頁

IV. 一工廠進行實驗，想知道五個不同機器 (machine) 之陰極玻璃棒讀數是否不同？每一機器有四個“頭” (head)，其上有玻璃製的陰極。每一個頭取四個讀數，以下有兩種分析方法，列於表3及表4 請問：

- 5 (11%) (a) 你認為那一個分析方法正確，請說明原因。
 (11%) (b) 又如果你要採用的分析方法是另一種 (你認為不正確的一種)，那麼實驗應如何進行才對？

表3 ⇒

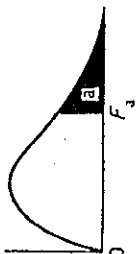
Head (H)	Machine (M)					
	A	B	C	D	E	
1	6	10	0	11	1	
	2	9	0	0	4	
	0	7	5	6	7	
	8	12	5	4	9	
2	13	2	10	5	6	
	3	1	11	10	7	
	9	1	6	8	0	
	8	10	7	3	3	
3	1	4	8	1	3	
	10	1	5	8	0	
	0	7	0	9	2	
	6	9	7	4	2	
4	7	0	7	0	3	
	4	3	2	8	7	
	7	4	5	6	4	
	9	1	4	5	0	
Source	df	SS	MS	EMS	F	F _{0.90}
M _i	4	45.08	11.27	$\sigma_e^2 + 16\phi_M$	1.05	2.04
H _j	3	46.25	15.48	$\sigma_e^2 + 20\phi_H$	1.45	2.18
MH _{ij}	12	236.42	19.70	$\sigma_e^2 + 4\phi_{MH}$	1.84	1.66
e _{k(ij)}	60	642.00	10.70			
Totals	79	969.95				

表4 ↓

Machine (M)	A				B				C				D				E			
Head (H)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	6	13	1	7	10	2	4	0	0	10	8	7	11	5	1	0	1	6	3	3
	2	3	10	4	9	1	1	3	0	11	5	2	0	10	8	8	4	7	0	7
	0	9	0	7	7	1	7	4	5	6	0	5	6	8	9	6	7	0	2	4
	8	8	6	9	12	10	9	1	5	7	7	4	4	3	4	5	9	3	2	0
Head totals	16	33	17	27	38	14	21	8	10	34	20	18	21	26	22	19	21	16	7	14
Machine totals	93				81				82				88				58			
Source	df	SS	MS	EMS	F	F _{0.90}														
M _i	4	45.08	11.27	$\sigma_e^2 + 4\sigma_H^2 + 16\phi_M$	<1	2.36														
H _{j(i)}	15	282.87	18.85	$\sigma_e^2 + 4\sigma_H^2$	1.76	1.60														
e _{k(ij)}	60	642.00	10.70	σ_e^2																
Totals	79	969.95																		

附表

Percentage points of the F distribution



Degrees of freedom (α = .05)

df ₁ \ df ₂	1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.46	2.45	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

From "Tables of Percentage Points of the Inverted Beta (F)-Distribution," *Biometrika*, Vol. 33 (1943), pp. 73-88, by Maxine Merrington and Catherine M. Thompson. Reproduced by permission of the *Biometrika* Trustees.

1. (16%) Sketch the following curves for an enzyme obeying Michaelis-Menten kinetics. Explain each of these curves briefly.

- (1) V vs. [S]
- (2) V vs. [E]
- (3) V vs. pH
- (4) V vs. Temperature

(Label the axes clearly. V: reaction rate, [S]: concentration of substrate, [E]: concentration of enzyme.)

2. (6%) The chemiosmotic hypothesis proposed by Peter Mitchell explains how the redox energy of electron transport is delivered to ATP synthetase in mitochondria. Describe the principle of this hypothesis. (A figure is better than a thousand words.)

3. (6%) Hormones can be divided into three classes base on their chemical structure. Describe these basic structures and give one example (name of hormone) to each of them.

4. (10%) Carbon dioxide is an indispensable participant in the biosynthesis of fatty acids. What is the specific role of CO_2 ? If a soluble liver fraction is incubated with $^{14}\text{CO}_2$ and other components required in fatty acid biosynthesis, does the resulting palmitate ($\text{C}_{15}\text{H}_{31}\text{COO}$) contain ^{14}C ? Explain.

5. (10%) What are ketone bodies? Describe the formation pathway of ketone bodies. What is the purpose of ketone-body formation?

6. (12%) Most plants in the tropics fix CO_2 by a route called the Hatch-Slack or C_4 pathway. Illustrate how this C_4 pathway functions in CO_2 fixation. What is the advantage of the C_4 pathway in comparison with the C_3 pathway in CO_2 fixation?

5 7. (10%) In the past, bacterial classification is mainly based on morphology, physiology and biochemical tests. Many symbiotic bacteria can not be cultivated, therefore, they can not be classified accordingly. How do you suggest it should be done. 5

8. (10%) The principle of DNA replication has been applied to many areas, such as : DNA sequencing and polymerase chain reaction. What ingredients are needed for the event ?

10 9. (10%) What are alleles ? How many alleles can a particular gene have (please indicate your reasoning) ? 10

15 10. (10%) What are Southern bolt, Northern bolt and Western bolt ? 15

20

25

(橫書式)

國立中山大學八十七學年度碩博士班招生考試試題

科目：生理學(海資所甲組選考)

共 1 頁 第 1 頁

問答題

1. 詳述人類生殖機轉上的優勢。(30分)
2. 詳述當你爬上玉山, 露營數天後, 下山回家"這過程你的生理反應。(35分)
3. 闡述神經系統與電腦的關係。(35分)

1. According to the projectile motion, the launching speed of a certain projectile is five times the speed it has at its maximum height. Calculate the elevation angle at launching. [10%]

2. Figure 2 shows a pendulum of length L . Its bob (which effectively has all the mass) has speed v_0 when the cord makes an angle θ_0 with the vertical. (a) Derive an expression for the speed of the bob when it is in its lowest position. What is the least value that v_0 can have if the pendulum is to swing down and then up (b) to a horizontal position, and (c) to a vertical position with the cord remaining straight? [20%]

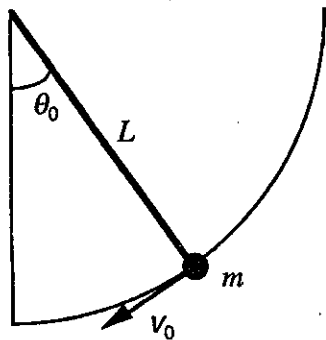


Fig. 2

3. A siphon is a device for removing liquid from a container. It operates as shown in Fig. 3. Tube ABC must initially be filled, but once this has been done, liquid will flow through the tube until the liquid surface in the container is leveled with the tube opening at A . The liquid has density ρ and negligible viscosity. (a) With what speed does the liquid emerge from the tube at C ? (b) What is the pressure in the liquid at the topmost point B ? (c) Theoretically, what is the greatest possible height h_1 that a siphon can lift water? [20%]

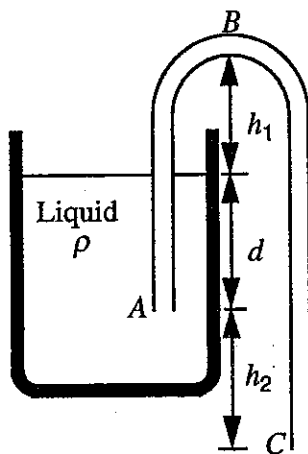


Fig. 3

4. A quantity of ideal monatomic gas consists of n moles initially at temperature T_1 . The pressure and volume are then slowly doubled in such a manner as to trace out a straight line on a p - V diagram. According to the kinetic theory of gases, in terms of n , R , and T_1 , what are (a) W , (b) ΔE_{int} , and (c) Q ? (d) If one were to define a molar specific heat for this process, what would be its value? [20%]

5. A charge $+q$ placed a distance a from an infinite conducting plane induces negative charge on the plane with a surface charge density $\sigma = -qa/(2\pi r^3)$, where r is the distance from the charge $+q$ to a point P on the plane (Fig. 5). What are (a) the magnitude E of the electric field normal to the plane due to this induced charge and (b) the total negative charge induced on the plane? (c) What is the electrostatic force between charge $+q$ and the induced charge on the conducting plane? Is the force attractive or repulsive? (d) What charge, placed diametrically opposite charge $+q$ (on the other side of the plane, at the same distance from the plane) will give this same force? [20%]

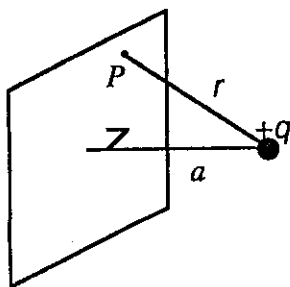
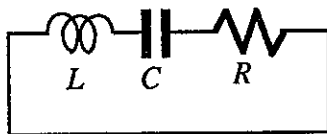


Fig. 5

6. A single loop consists of several inductors (L_1, L_2, \dots), several capacitors (C_1, C_2, \dots), and several resistors (R_1, R_2, \dots) connected in series as shown, for example, in Fig. 6a. Show that regardless of the sequence of these circuit elements in the loop, the behavior of this circuit is identical to that of the simple LC circuit shown in Fig. 6b. [10%]



(a)



(b)

Fig. 6

一、解釋名詞 (每小題 4 分, 共 20 分)

1. Principle of uniformitarianism
2. Slaty cleavage
3. Asthenosphere
4. Island arc
5. Index fossil

二、問答題 (每小題 10 分, 共 80 分)

1. 依成因可將岩石分為那幾大類? 說明它們之間的關連。
2. 塊體運動 (mass wasting) 的發生常造成許多地質災害, (a) 試敘述控制塊體運動的因素, (b) 如何防治一可能發生塊體運動的不穩定斜坡?
3. 試敘述風化作用 (weathering) 的種類及其特徵。
4. 火山噴發的型式有劇烈爆發與寧靜式噴發兩種主要類型, 試敘述那些因素會影響火山的噴發情形。
5. (a) 何謂板塊地體構造學說 (plate tectonics)? (b) 試說明支持此學說之重要證據。
6. (a) 針對地球的結構與分層, 說明其特性。 (b) 我們如何獲得上述有關地球內部組成之資料?
7. (a) 如何判定岩層形成時的相對地質時間與測定絕對地質時間? (b) 地球的年齡是多少? (c) 現今海洋中最老的海洋地殼的年齡是多少?
8. (a) 試敘述在中洋脊 (mid-ocean ridge) 和隱沒帶 (subduction zone) 處有那些地質作用。 (b) 這些作用和礦產資源有什麼關係?

一、試繪出海水溫度之典型垂直剖面分佈？可以分成幾層？各有何特性？在研究船上是用什麼儀器來量測的？(10分)

二、試繪出聲波速度在海水中的垂直剖面分佈？它和上題的溫度分佈有相關嗎？何謂 sound channel？有何特性？(20分)

三、潮汐是如何產生的？可以分成幾種型態？neap tide (大潮) 是如何形成的？spring tide (小潮) 是什麼？(20分)

四、以北太平洋為例，說明其表層洋流的概況？它形成的主要原因是什麼？它在西方邊界的洋流與東方邊界相比有何不同(從流速、寬度、深度、溫度、湧升流和生產力等方面來說明)？(20分)

五、解釋名詞(每題5分)

(1) potential temperature (位溫)

(2) tsunami (海嘯波)

(3) swell (湧浪)

(4) internal wave (內波)

(5) Ekman spiral (艾克曼螺旋)

(6) geostrophic current (地衡流)

一. 解釋名詞 (每小題 4 分, 共 24 分)

- | | |
|----------------------|------------------------|
| 1. 礦物 (mineral) | 4. 自形的 (euhedral) |
| 2. 對稱 (symmetry) | 5. 同素異型 (polymorphism) |
| 3. 晶形 (crystal form) | 6. 偏析 (exsolution) |

二. 問答題 (第 1~6 小題, 每題 10 分; 第 7 和 8 小題, 每題 8 分, 共 76 分)

1. 礦物依其晶胞參數 (lattice parameters) 之不同可分為那幾種晶系 (crystal system)? 並描述之。
2. 依化學成份區分, 有那幾大類型之礦物? 其中那一種類型的礦物在地殼中最常見? 並舉出三種該類型礦物之例子。
3. 列舉並說明礦物的物理性質。
4. 何謂固溶體 (solid solution)? 在什麼情形與條件下容易有固溶體的形成? 並舉出一個固溶體系列之例子, 寫出其端成份 (end-member composition)。
5. 在野外通常如何對礦物作初步的鑑定? 而在實驗室中有那些儀器與方法可以用來鑑定並確認礦物?
6. 有一橄欖石 (olivine) 晶体, 已知其化學成份為 $MgO = 56.17\%$, $FeO = 2.05\%$, $SiO_2 = 41.85\%$ (重量百分比), 試計算此橄欖石之化學式 (需寫出計算過程, 原子量: $O = 16$, $Mg = 24.3$, $Fe = 55.8$, $Si = 28$)。
7. 射移面 (glide) 和二重旋轉軸 (2_1 screw axis) 有什麼不同? 試繪圖說明之。
8. 試敘述研究礦物學有什麼意義和重要性。

一、假設流場的速度為 $\vec{V} = 3tx\vec{i} - t^2y\vec{j} + 2xz\vec{k}$, 請問此流場為

(a) steady 或 unsteady (怎麼看的)? (3分)

(b) 2 dimensional 或 3 dimensional (怎麼看的)? (3分)

(c) 求其 local acceleration? (4分)

(d) 求其 convective acceleration? (7分)

二、如下圖, 計算A點的 gage pressure 是多少 pascals? 它比大氣壓力高或低? (17分)

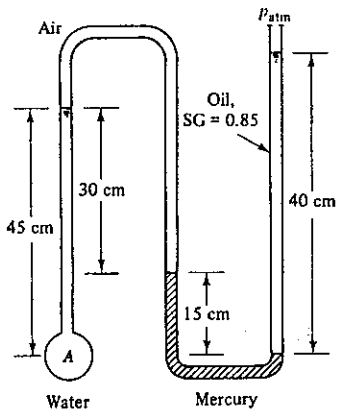


Table 2.1

SPECIFIC WEIGHT OF SOME COMMON FLUIDS

Fluid	Specific weight ρg at 68°F = 20°C	
	lbf/ft ³	N/m ³
Air (at 1 atm)	0.0752	11.8
Ethyl alcohol	49.2	7,733
SAE 30 oil	57.3	8,996
Water	62.4	9,790
Seawater	64.0	10,050
Glycerin	78.7	12,360
Carbon tetrachloride	99.1	15,570
Mercury	846	133,100

三、解釋名詞 (每題 6分)

(1) Mach number (馬赫數)

(2) Cavitation (空蝕)

(3) Lagrangian 方式來描述流動

(4) incompressible^{flow} (不可壓縮流動)

(5) Continuity equation

(6) boundary layer (邊界層)

(7) Reynolds number

(8) Bernoulli's equation

(9) drag coefficient

(10) Newtonian fluid (牛頓流体)

(11) hydraulic diameter

ANSWER all OF THE FOLLOWING QUESTIONS, EACH OF WHICH CARRIES 10 OUT OF 100 POINTS.

應用以下資訊找出 a, b, c 之值

1. Use the following information to find the values of a, b and c in the formula

$$f(x) = (x + a)/(bx^2 + cx + 2).$$

a, b, c 之值只取 0 或 1.

- The values of a, b and c are either 0 or 1.

f 之圖通過點 $(-1, 0)$.

- The graph of f passes through the point $(-1, 0)$.

直線 $y = 1$ 為 f 之漸近線.

- The line $y = 1$ is an asymptote of the graph f .

求以下極座標曲線之弧長.

2. Find the length of the polar curve

$$r = \sqrt{1 + \cos 2\theta}, \quad 0 \leq \theta \leq \pi\sqrt{2}.$$

(a) 證明：若 u 為以 t 為變量之可微向量函數且向量的長度恒為一常數值，則 u 恒與其導函數垂直。

3. (a) Prove that if u is a differentiable vector function of t of constant length then

$u(t)$ 之長度恒為一常數值，則 u 恒與其導函數垂直。

u is always perpendicular to its derivative du/dt .

(b) 求以下空間曲線在點 $t = 0$ 處之單位切向量 T ,

(b) Find the unit tangent vector T , the unit normal vector N , the binormal vector

單位法向量 N ，二法向量 B ，曲率 κ ，及扭率 τ 。

B , the curvature κ , and the torsion τ of the space curve

$$r(t) = \frac{4}{9}(1+t)^{3/2}i + \frac{4}{9}(1-t)^{3/2}j + \frac{1}{3}tk$$

at $t = 0$.

求函數 f 之所有可能的極大值、極小值、及鞍點，
 4. Find all possible local maximum, local minimum and saddle points of the function

$$f(x) = x^3 - 3x - 4,$$

且計算出這些值。並繪畫 f 的圖形。
 and evaluate the values of f at these points. Also, sketch the graph of f .

決定以下瑕積分是否
 5. Determine whether the improper integral

$$\int_0^1 \ln x \, dx.$$

收斂或發散。若收斂時，求其積分值。
 converges or diverges, and evaluate it if it converges.

證明球面之面積為 $4\pi r^2$ ，其中 r 是半徑。
 6. Show that the surface area of a sphere with radius r is $4\pi r^2$.

考慮數列 $\{a_n\}$ ， a_n 之遞迴定義為： $a_1 = \sqrt{2}$ ， $a_n = \sqrt{2a_{n-1}}$ ，
 7. Consider the sequence $\{a_n\}$ defined recursively by $a_1 = \sqrt{2}$ ， $a_n = \sqrt{2a_{n-1}}$ ，for each
 $n \geq 2$ 。證明 $\{a_n\}$ 收斂且計算其極限值。
 $n \geq 2$. Show that $\{a_n\}$ converges and evaluate the limit.

(a) 證明 $\sum_{n=1}^{\infty} \tan(1/n)$ 發散。
 8. (a) Show that $\sum_{n=1}^{\infty} \tan(1/n)$ diverges.

(b) 證明 $\sum_{n=1}^{\infty} (\tan(1/n))^2$ 收斂。
 (b) Show that $\sum_{n=1}^{\infty} (\tan(1/n))^2$ converges.

(c) 問對於 k 之何值， $\sum_{n=1}^{\infty} (\tan(1/n))^k$ 收斂？證明您的
 (c) For which values of k does $\sum_{n=1}^{\infty} (\tan(1/n))^k$ converge? Prove your result.

答案。

估算以下積分

9. Approximate the integral.

$$\int_0^{0.1} \frac{\sin x}{x} dx$$

之約值至小數點後三位.
upto 3 decimal digits.

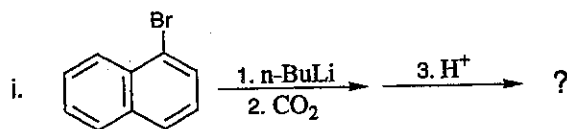
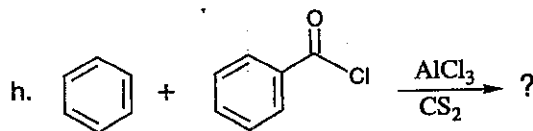
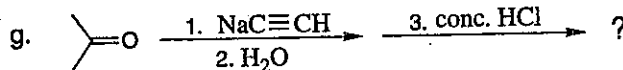
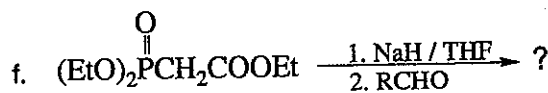
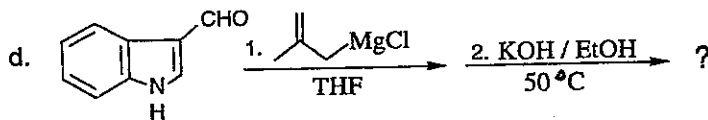
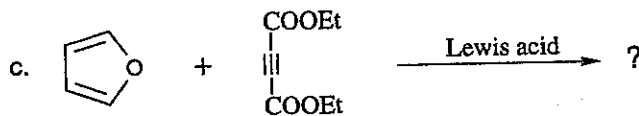
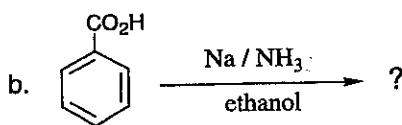
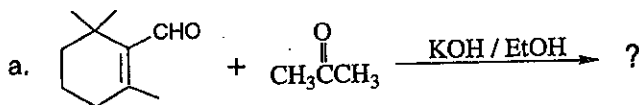
證明 Rolle 引理. 設 f 為 $[a, b]$ 上之連續實數值函數,
10. Prove the Rolle's Lemma: Let f be a continuous real-valued function defined on
且 f 在 (a, b) 上可微. 若 $f(a) = f(b) = 0$ 則存在 (a, b) 中之某 c
[a, b] and differentiable on (a, b) . If $f(a) = f(b) = 0$ then there is a point c in (a, b)
使得
such that

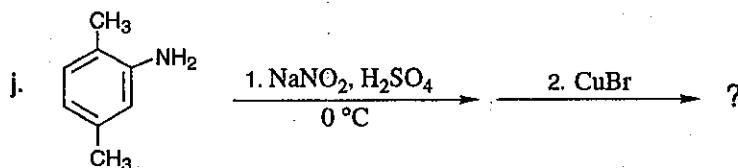
$$f'(c) = \frac{f(b) - f(a)}{b - a} = 0.$$

您不能应用均值定理来解决此题.
You are NOT allowed to use the mean value theorem in this question.

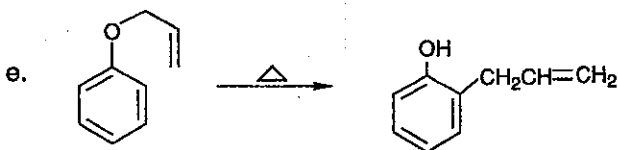
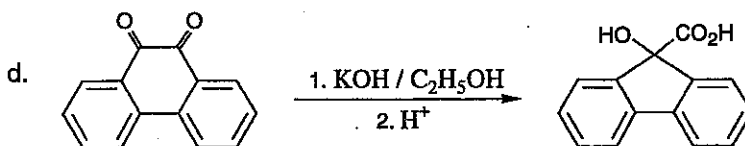
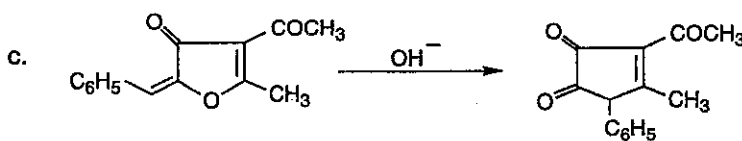
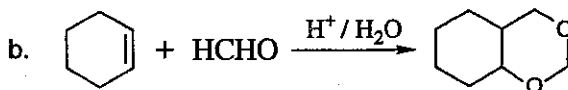
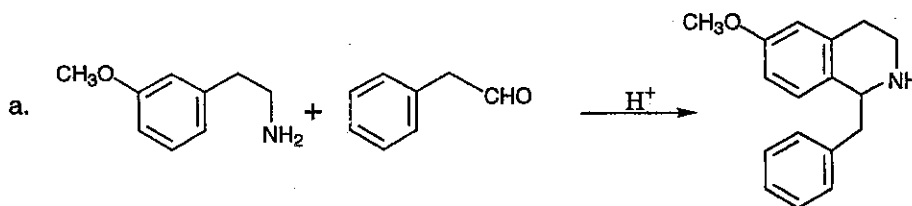
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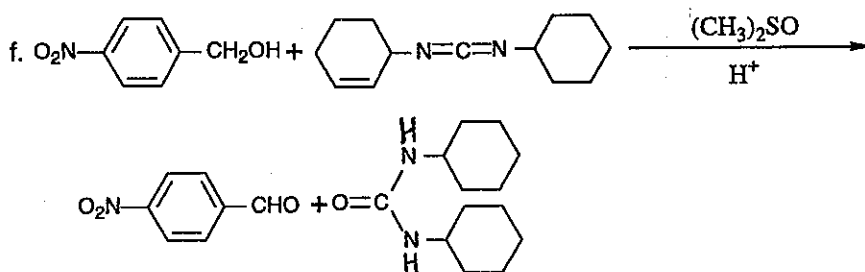
1. Complete the following reactions. (40%)





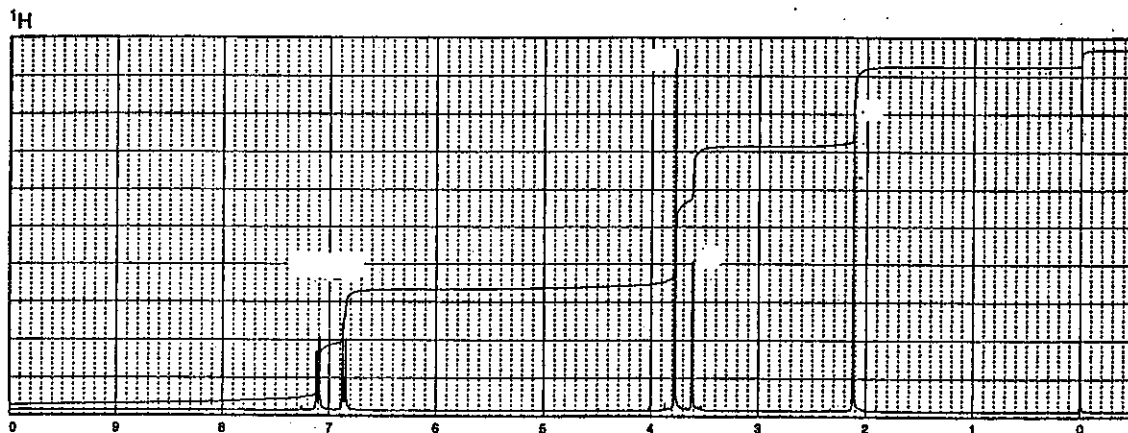
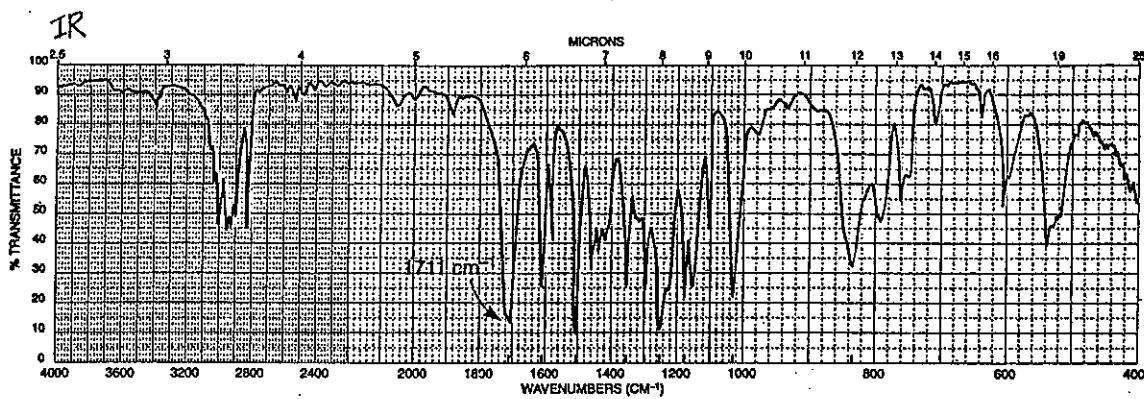
2. Illustrate the mechanisms for the following transformations. (42%)





3. Determine the structures which would be consistent with the following spectra. (18%)

a. $\text{C}_{10}\text{H}_{12}\text{O}_2$.



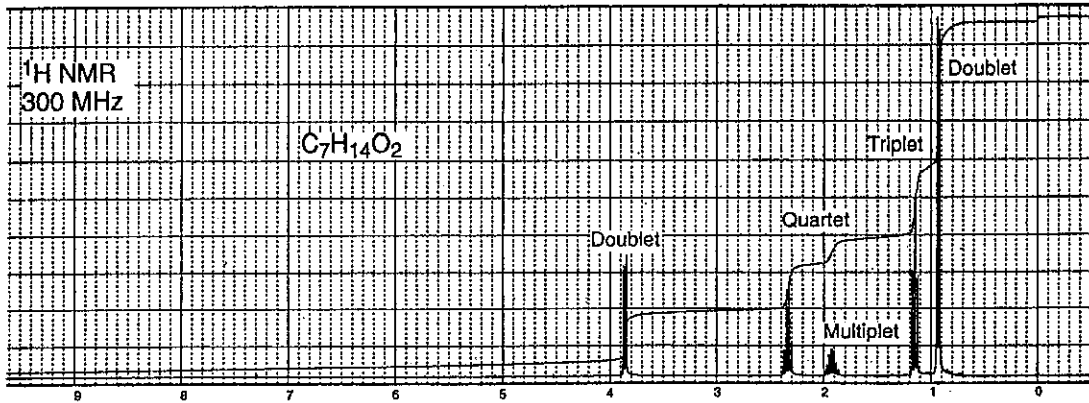
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國立中山大學八十七學年度碩博士班招生考試試題

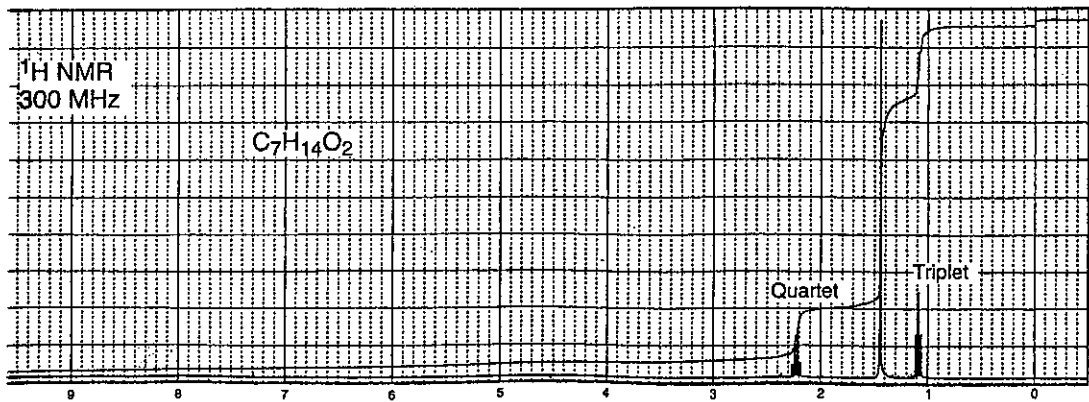
科目：有機化學(海濱所丙組)

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b.



c.

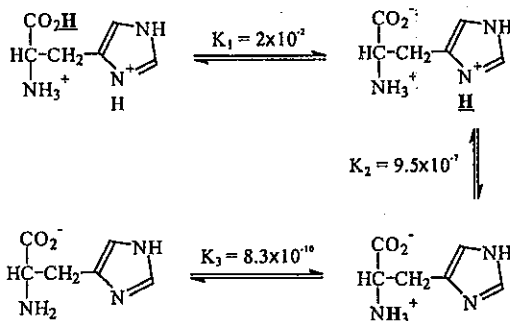


1. (12%) Comment on the following cleaning procedures. If you think the procedure is bad, state your reason why it is bad and correct it.
- (a) (3%) Soak glass beakers in KOH/EtOH solutions and rinse them thoroughly with deionized water right before use.
- (b) (3%) Soak volumetric flasks in KOH/EtOH solutions and rinse them thoroughly with deionized water.
- (c) (3%) Soak volumetric flasks in cold detergent and rinse them thoroughly with deionized water right before use.
- (d) (3%) Dry the clean but wet volumetric flask in a 100 °C oven.
2. (12%) Write each answer with correct significant figures. Find the absolute uncertainty and percent relative uncertainty for each answer.
- (a) (6%) $(3.24 \pm 0.08)^4$
- (b) (6%) $(3.24 \pm 0.08)^2 \times (3.24 \pm 0.08)^2$

type of calculation	example	standard deviation of y
addition or subtraction	$y = a + b - c$	$s_y = \sqrt{s_a^2 + s_b^2 + s_c^2}$
multiplication or division	$y = a \times b / c$	$\frac{s_y}{y} = \sqrt{\left(\frac{s_a}{a}\right)^2 + \left(\frac{s_b}{b}\right)^2 + \left(\frac{s_c}{c}\right)^2}$
exponentiation	$y = a^x$	$\frac{s_y}{y} = x \frac{s_a}{a}$
logarithm	$y = \log_{10} a$	$s_y = 0.434 \frac{s_a}{a}$
antilogarithm	$y = \text{antilog}_{10} a$	$\frac{s_y}{y} = 2.303 s_a$

3. (21%) Calculate the solubility of $\text{Fe}(\text{OH})_3$ ($K_{sp} = 4 \times 10^{-38}$) in water. Approach this question by the following steps:
- Step 1. (3%) Write the relevant chemical equation.
- Step 2. (2%) Define unknown. (solubility =)
- Step 3. (1%) Equilibrium-constant expressions.
- Step 4. (3%) Write mass-balance equation.
- Step 5. (3%) Write charge-balance equation.
- Step 6. (3%) Approximations.
- Step 7. (4%) Solve equations.
- Step 8. (2%) Check assumptions.
4. (5%) Which of the following bases would be most suitable for preparing a buffer of pH = 9.00? You need to provide your reason.
- Ammonia ($K_b = 1.75 \times 10^{-5}$), aniline ($K_b = 3.99 \times 10^{-10}$), hydrazine ($K_b = 3.0 \times 10^{-6}$), or pyridine ($K_b = 1.69 \times 10^{-9}$).

5. (10%) Histidine is a triprotic amino acid:



What is the value of the equilibrium constant for the reaction?



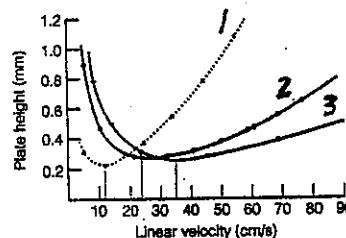
6. (15%) Use the data in the following table and Beer's Law to evaluate the missing quantities.
(The molecular weight of the analyte is 250.)

A	% T	ϵ	b	c	c
absorbance	transmittance	molar absorptivity	(cm)	(M)	(ppm)
(a)	45.5	(b)	2.10	8.15×10^{-3}	(c)

7. (10%) An unknown sample of $\text{Fe}(\text{SCN})^{2+}$ gave UV/Vis absorbance of 2.36 (arbitrary unit). When 0.500 mL of solution containing 0.0287 M $\text{Fe}(\text{SCN})^{2+}$ was added to 25.0 mL of unknown, the absorbance increased to 3.79.

- (a) (3%) Is this a standard addition method or an internal standard method? (Two points deduction if the answer is incorrect.)
(b) (7%) Find $[\text{Fe}(\text{SCN})^{2+}]$ in the unknown.

8. (15%) The figure shown in the right is van Deemter curves for GLC of $n\text{-C}_{17}\text{H}_{36}$ at 175°C , using N_2 , He, or H_2 in a 0.25-mm-diameter x 25-m long wall-coated column. Given: solutes diffuse more rapidly through H_2 and He than through N_2 .



- (a) (10%) Which of the three curve is the van Deemter curve for N_2 ? Why?
(b) (5%) Which curve (gas) will you use if you want to run the GLC at a faster flow rate? (i.e. curve 1, 2, or 3) Why?