

國立中山大學九十三年度碩士班招生考試試題

科目：普通生物學 海濱系碩士班 甲組

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1. What four processes are involved in the nitrogen cycle? Why is nitrogen fixation important to all organisms? What is the primary nitrogen source for plants? In what form is nitrogen passed through the consumer level? 15%
2. What conditions favor the formation of coral reefs? How does the structure of coral reefs result in such a diverse community? 10%
3. What thermoregulatory adaptations are found in animals other than terrestrial mammals? 15%
4. How do photoautotrophs and chemoautotrophs acquire the energy needed to synthesize organic molecules? What are some examples of each? 10%
5. 以能量的觀點，說明單細胞演化為多細胞的優勢。25%
6. 為使體內細胞得到充分氧氣，低等到高等動物做了那些演化，請詳述。25%

1. 說明 physiology 的意義 (10 分)，簡述 molecular physiology (10 分)。
2. 詳述女性排卵後，體溫升高的生理機制 (20 分)。
3. 繪圖說明 electrical synapse (20 分)。
4. 詳述面臨 stress 時，人體的反應 (20 分)。
5. 詳述 cardiac cycle (20 分)。

1. (10%) Compare the structures of DNA helix and protein α helix.
2. (10%) How can cytosine convert to thymine?
3. (10%) How does NADH convert to ATP?
4. (10%) Design a primer set (5 mer) to amplify the following DNA sequence.
AAGGCTTCC.....ACTTGGAACCTG
TTC CGTTCC.....TGAACCTGGAC
5. (10%) What are needed for DNA polymerase to replicate DNA?
6. (20%) What are the common methods for protein purification? Please describe the principles behind the methods.
7. (30%) Define the following terms
 - a). Nested PCR
 - b). Apoptosis
 - c). Chaperone
 - d). Chargaff's rules
 - e). Contig
 - f). Degeneracy
 - g). Domain
 - h). Disulfide bond
 - i). Alleles
 - j). Operon

國立中山大學九十三年學年度碩士班招生考試試題

科目：生態學（海洋資源研究所 乙組 選考）

共 1 頁 第 1 頁

一、請詳細解釋下列的生態專有名詞（50%，每題 5 分）

1. Tolerance limit
2. K-selection
3. Cline
4. Age pyramid
5. Logistic growth
6. Niche
7. Thermocline
8. Upwelling
9. Continental shelf
10. Hydrothermal vent

二、問答（50%，每題 10 分）

1. 請論述並舉例說明生態系中的物種間有那些交互關係？（10%）
2. 何謂 "Species"？請說明有那些認定的標準？（10%）
3. 臺灣四面環海，擁有許多的海洋環境，請就你所知說明臺灣周邊海域有那些特殊的海洋環境？（10%）
4. 何謂 "溫室效應"？請詳細說明其產生的原因以及防範之策？（10%）
5. 請論述 "長江三峽大壩" 興建過程及完成後，有那些陸域及海域生態上的衝擊？（10%）

國立中山大學九十三年度碩士班招生考試試題

科目：生物統計學（海洋資源系碩士班乙組）

共 2 頁 第 1 頁

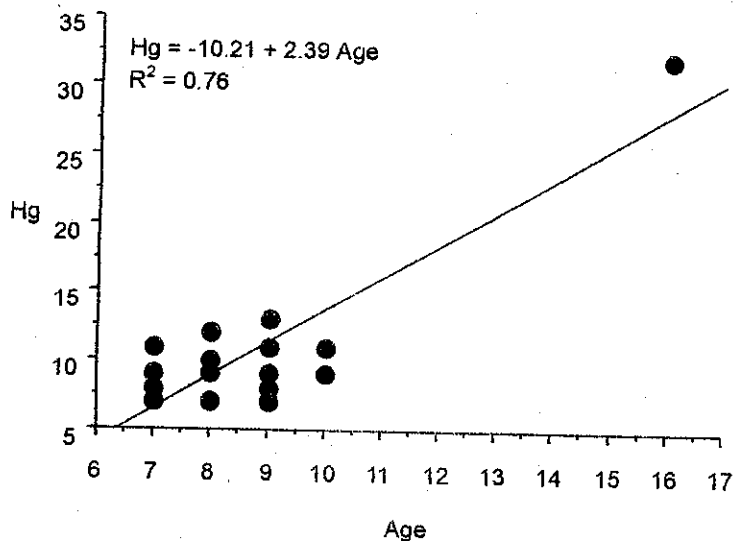
1. 由以下表格，請回答下列問題(共 46%)：

- (1) 解釋名詞：SS, df, F, P (8%)
- (2) 請完成下表中 a-h 之空格 (16%)
- (3) 這個實驗 species (P) 有幾個 (3%)? 每個 cell (PS x P x A) 內之重覆個數 (replication number) 有幾個? (4%)
- (4) 統計分析中，得到什麼結論 ($\alpha=0.05$)? 請條列說明(15%)

Table 1. ANOVA (fixed effects) on the predation percentages (number of predated rotifers/total number of rotifers x 100) of the copepod *D. bicuspidatus odessanus*. Initial prey density was 40 rotifers ml⁻¹.

Source	SS	df	F	P
Predator sex (PS)	0.101	1	6.892	0.010
Prey species (P)	0.798	2	27.162	<0.001
Prey age (ovigerous vs. neonate; A)	0.045	1	3.076	0.082
PS x P	0.016	a	e	0.576
PS x A	0.036	b	f	0.119
P x A	0.052	c	g	0.306
PS x P x A	0.006	d	h	0.804
Error	1.587	108		

2. 假設大專聯考生物科考試成績是常態分佈，今逢機選 25 人預試，得到成績的平均為 65.3 分，標準差(standard error, s)是 20 分，請以此估計大專聯考成績平均的 95% 可信界限(confidence interval) (16%)。
3. 環保署想調查某工廠廢水排放對水中溶氧的影響。因此逢機在此工廠外排水道取樣，一個月內共取 49 個樣品，其平均溶氧為 5.0 ppm，標準差(standard error)為 0.70 ppm，請用此樣品數據決定此工廠排水平均溶氧是否小於 5.2 ppm. ($\alpha=0.05$) (18%)。
4. 某研究人員想瞭解魚肌肉內汞的濃度與其年齡的關係，此研究人員採了一批魚，由耳石鑑定其年齡，取肌肉以原子吸收儀測汞濃度，將數據點出如下圖，其中橫軸為年齡(Age)，縱軸為汞(Hg)濃度，並計算迴歸直線如下(列於圖中)，請問你(妳)拿到此數據，同意該研究員的分析嗎？若同意請由以下結果說明結論；如不同意，你(妳)會如何處理？其結論可能為何？ (20%)



國立中山大學九十三年學年度碩士班招生考試試題

科目： 生物統計學 (海洋資源系碩士班乙組)

附表

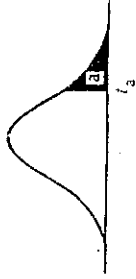
Normal curve areas



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4978	.4979	.4979	.4980	.4981	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

This table is abridged from Table 1 of *Statistical Tables and Formulas*, by A. Hald (New York: John Wiley & Sons, 1952). Reproduced by permission of A. Hald and the publishers, John Wiley & Sons.

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 Herrington, *Biometrika*, Vol. 32 (1941), p. 300. Reproduced by permission of the *Biometrika* Trustees.

國立中山大學九十三年度碩士班招生考試試題

科目：普通物理學（海資所）（丙組 選考）

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計算題共 10 題每題 10 分

1. How much energy is required to launch a 230 kg package on a vertical trajectory that peaks at a height of 1800 km. (10%)
2. A spring has a force constant of 5.20 N/m and an equilibrium length of 0.10m. If this spring is compressed by a distance of 0.010m. Find the elastic potential energy stored in this spring. (10%)
3. A disk has a rotational moment of inertia of 6.0 kgm². A torque is applied to this disk to cause a constant angular acceleration of 2.0 rad/s². If its initial angular speed is zero, find its angular speed after it has been accelerated for 5.0 s. What is its kinetic energy at this time? (10%)
4. The wall of a large tank has a hole located 1.00m below its edge. If this tank is filled with water up to the edge find the speed of water when it leaves the hole. (10%)
5. A particle of mass m is moving with a velocity $v=vi$, where i is the unit vector in the x direction. This particle collides elastically with a particle of the same mass at rest. If the second particle moves in a direction 45° from the x -axis after the collision, find the final velocities of these two particles. (10%)
6. The wavelength and amplitude of a sinusoidal wave are 16cm and 2.5cm, respectively. This wave propagates along the x direction with a speed of 3.5 cm/s. Find the angular frequency and wave number of this wave. (10%)
7. One end of a spring is attached to a vertical wall and another end is attached with a mass of 0.05kg. If this mass can move on a horizontal surface without any friction. Obtain the vibration frequency of this mass if the spring constant is 2.50N/m. (10%)
8. A 940 g stone is tied to the end of a 1.3m long string. The maximum tension, which this string can sustain, is 120N. If another end of this string is fixed and the stone is moving around this fixed point in a horizontal circular motion. Find the maximum speed of this stone, with which this string will not break. (10%)
9. Calculate the electric field and potential of a uniformly charged sphere with a radius of R and a total charge of Q . (10%)
10. A resistor R has a resistance of $1.0 \times 10^3 \Omega$ and a capacitor C has a capacitance of $1.00 \times 10^{-4} F$. R and C are in series with a 10V battery. If the battery is replaced by a metal wire at $t=0$, find the time at which the voltage across the capacitor drops down to 5.0V. (10%)

國立中山大學九十三年學年度碩士班招生考試試題

科目：普通地質學

海濱所(兩組,選考)

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一、解釋名詞(每小題 2.5 分,共 25 分)

- | | |
|------------------------------|-------------------------------|
| 1. porphyritic rock | 6. meander |
| 2. epicenter | 7. principle of superposition |
| 3. pegmatite | 8. mass wasting |
| 4. metasomatism | 9. topographic map |
| 5. convergent plate boundary | 10. index fossil |

二、問答題(1~5 題每小題 5 分,6~10 題每小題 10 分,共 75 分)

1. 假設以下岩石處於潮濕的氣候中,請按其風化速率由快至慢(易風化→不易風化)加以排列:花崗岩,長石砂岩(Arkose),石英砂岩,石灰岩,和岩鹽(Rock salt)。(5%)
2. 說明地震的規模(magnitude)和震度(intensity)有何不同?(5%)
3. 何謂 Erosion 和 weathering?二者有什麼不同?(5%)
4. 地層層態(Attitude)包含那兩個要素?在地質圖上如何表示。試繪出並加說明。(5%)
5. 何謂板狀劈理(slaty cleavage)?其是如何形成?(5%)
6. 台灣中部曾經發生九二一大地震,造成重大傷亡,(a)試說明這個地震發生的機制。(b)若和美國舊金山地區經常發生的地震作比較,兩者間地震發生的機制(成因上)有什麼不同?(10%)
7. (a)說明利用那些方法(或材料)可以來研究地球的內部構造?(b)繪一剖面圖說明地球內部構造。(10%)
8. (a)試說明變質作用的類型?(b)台灣產有很多變質岩,請問台灣的變質岩分佈於哪裡?台灣的變質岩屬於什麼類型?(10%)
9. 支持板塊構造運動學說(plate tectonics)的重要證據有哪些?詳細說明之。(10%)
10. 要形成石油和天然氣的油氣田需要有哪些地質條件的配合?說明之。(10%)

國立中山大學九十三年學年度碩士班招生考試試題

科目：微積分 (選考) 【海洋資源學系碩士班 丙組】

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1. 求下列極限：(20分)

(a) $\lim_{x \rightarrow 2^+} \frac{x^2 - 4}{[x]^2 - 4}$ (b) $\lim_{x \rightarrow \infty} \frac{\sqrt{x}}{[x]}$ (c) $\lim_{n \rightarrow \infty} (1 + n + n^2)^{\frac{1}{n}}$ (d) $\lim_{x \rightarrow \infty} (x - \sqrt{x^2 + x})$

其中 $[\cdot]$ 表最大整數函數。

2. 求下列積分：(30分)

(a) $\int \ln(x^2 + 1) dx$ (b) $\int \frac{1}{1 + 3\cos x} dx$ (c) $\int \frac{x^4 + 3x^2 + x - 2}{x^3 - 1} dx$

3. 試求由直線 $y = x$ 與函數 $f(x) = x^3 - 2x^2 + 2$ 之圖形所圍區域之面積。(10分)

4. 試求 $\iint_A x^2 dA$, 其中 A 為由 $xy = 16$, $y = x$, $y = 0$ 與 $x = 8$ 在第一象限所圍區域。(10分)

5. 試求雙曲面 $x^2 + y^2 - z^2 = 18$ 於點 $(3, 5, -4)$ 之切平面及法線。(10分)

6. 試求級數 $\sum_{n=1}^{\infty} \frac{n!}{n^n} x^n$ 之收斂區間。(10分)

7. 試求函數 $f(x) = x^x$, $x \in (0, \infty)$ 之極值。(10分)

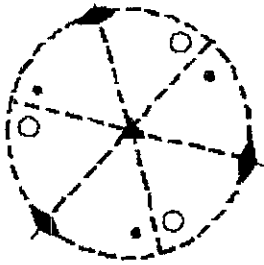
國立中山大學九十三年學年度碩士班招生考試試題

科目：礦物學 (選考) 【海洋資源學系碩士班 丙組】

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一、 填充題 (共四小題; 每小空格 2.5 分, 共 20 分)

1. The symmetry operation that produces an identical motif after a translation of one-half of a unit cell followed by a mirror operation is called a _____.
2. The space group of rutile (金紅石, TiO_2) is $P4_2/mnm$. It has a _____ Bravais lattice and the point group _____ in the _____ crystal system.
3. For the following figures, what are the:
Crystal system: _____, Symmetry elements: _____
Point group: _____



4. The mineral Olivine:
 - a) Forms euhedral crystals when it grows in a melt that cools slowly.
 - b) Is a mineral where iron and manganese can substitute for one another.
 - c) Will change into a new mineral when introduced to hot water because it forms at low temperatures.
 - d) Is an example of a nesosilicate made up of isolated silicon oxygen tetrahedra.The choice is: _____

二、 問答題 (共 80 分)

1. 如何從物理性質分辨石英、長石和方解石? (10%)
2. 矽酸鹽礦物可分為那幾大類? 試繪圖說明並各舉一個礦物實例。(10%)
3. 在某大學就讀地質系的阿美在野外採了一塊岩石, 她想鑑定並且確認這是什麼岩石, 請問:
 - (a) 她需要從這塊石頭身上獲得什麼資料才能用來鑑定它?
 - (b) 她可以用那些方法來獲得這些資料?
 - (c) 阿美分析了這塊石頭中的一個大小只有 0.2 mm 的礦物顆粒之化學成份, 得到以下分析值:
 $\text{SiO}_2 = 50.38\%$, $\text{Al}_2\text{O}_3 = 3.01\%$, $\text{TiO}_2 = 0.45\%$, $\text{Fe}_2\text{O}_3 = 1.95\%$, $\text{FeO} = 4.53\%$, $\text{MgO} = 14.69\%$,
 $\text{CaO} = 24.32\%$, $\text{Na}_2\text{O} = 0.46\%$ (重量百分比), 試計算此礦物之化學式,

(需寫出計算過程，原子量 O = 16.0, Si = 28.1, Al = 27.0, Ti = 47.9, Fe = 55.8, Mg = 24.3, Ca = 40.1, Na = 23.0)

(d) 若根據此化學式，請判斷這個礦物是何種礦物。(15%)

4. (a) 晶體之相變可分為那幾類？各有何特徵？

(b) 試以石英為例，說明為什麼在自然界，在室溫室壓的條件下，可以找到鱗石英 (tridymite) 和方石英 (cristobalite)，但卻找不到β-石英。(10%)

5. 試舉出三種固熔體礦物的例子，並寫出端成份礦物或指出主要的相互取代元素。(10%)

6. 試從鍵結的角度說明金剛石和石墨的物理性質及其差異性。(10%)

7. 附圖為螢石 (fluorite) 之結構圖

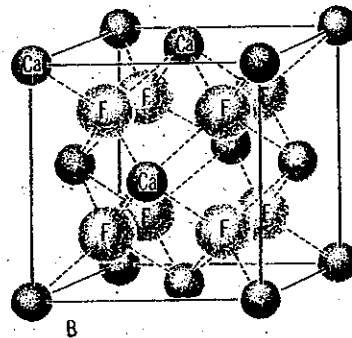
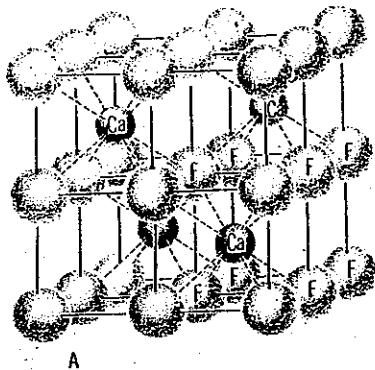
(a) 利用配位數觀念導出螢石的化學式

(b) 螢石的晶胞 (unit cell) 中包含幾個 Ca 和 F 離子？Z = ?

(c) Ca 和 F 原子分別以什麼方式堆積排列？

(d) 螢石常常長成正八面體的外型，其具有哪些對稱性質 (對稱元素)？

(e) 從結構圖上看，螢石屬於何種晶系 (crystal system)？何種晶族 (crystal class)？(15%)



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請注意：(a) 若涉及計算，請將演算過程列出，否則不予計分。

(b) $\log 2=0.30$, $\log 3=0.48$

(12%) 1. Distinguish between

- (a) the equivalent point and the end point of a titration.
- (b) the density and the specific gravity of a solution.
- (c) a primary standard and a secondary standard.

(5%) 2. Evaluate the standard deviation for the accompanying set of data:

17.91, 18.04, 17.95

(8%) 3. The solubility-product constant for cadmium carbonate is 4.0×10^{-14} .

Calculate the equilibrium solubility of CdCO_3 in

- (a) water.
- (b) a solution that is 0.10 M with respect to carbonate ion.

(5%) 4. What will be the pH of a 1.00×10^{-2} N NaOH solution at 0°C ? (K_w at 0°C is 1.00×10^{-15})

(5%) 5. At 480 nm, a 4.01×10^{-5} M solution of FeSCN^{2+} has a transmittance of 50.0% when measured in a 1-cm cell. What will be the percent transmittance if a 4-cm cell is used for measurement?

(6%) 6. A typical infrared spectrophotometer covers a wavelength range from 3 to 15 μm . Express its range

- (a) in wavenumbers
- (b) in hertz

(5%) 7. How do you prepare a pH 4.5 buffer solution with 1.00 M CH_3COOH and 1.00 M NaOH? (No pH meter is available. For CH_3COOH , $\text{p}K_a=4.8$)

(6%) 8. Suggest a method for the determination of the amounts of H_3PO_4 and NaH_2PO_4 in an aqueous solution.

(For H_3PO_4 , $\text{p}K_{a1}=2.1$, $\text{p}K_{a2}=7.2$, $\text{p}K_{a3}=12.3$)

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(15%) 9. Briefly describe or define the following terms:

- (a) standard hydrogen electrode
- (b) standard electrode potential
- (c) salt bridge
- (d) Nernst equation
- (e) electrochemical cell

(5%) 10. Why is atomic emission more sensitive to flame instability than atomic absorption?

(8%) 11. The distribution coefficient for the species Z between carbon tetrachloride and water is 10. Calculate the concentration of Z remaining in the aqueous phase after 50 ml of 0.100 M Z is treated by extraction with

- (a) 50 ml of CCl_4
- (b) two 25-ml portions of CCl_4

(15%) 12. Define the following terms used in HPLC :

- (a) sparging
- (b) guard column
- (c) gradient elution
- (d) isocratic elution
- (e) reversed-phase packing

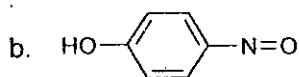
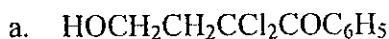
(5%) 13. Describe the principle of size-exclusion chromatography.

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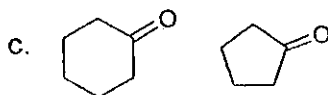
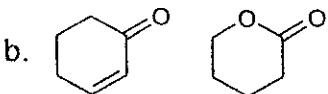
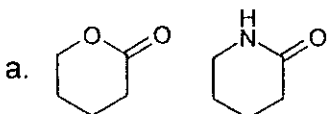
科目： 有機化學 海資所 丁組

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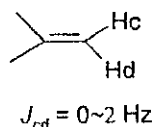
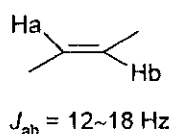
- Write structures for the following compounds. (2% each)
 - p*-Chlorobenzoic acid
 - 2-Butyl-4-methylpentanoate
 - 3-Carboxycyclobutene
 - N-Methyl-N-phenylacetamide
 - 3-Methyl-3-ethyl-1-pentyne
 - 3-Amino-1-cyclopentene
 - Hex-1-en-3-on-4-ol
- Write the structure of a proton tautomer of each of the following. Show resonance forms (if any) for the intermediate anion in the tautomerism. (3% each)



- Write the principle resonance forms for the aromatic $\text{C}_4\text{H}_5\text{N}$. (5%)
- Use IR spectra to distinguish the following pairs of compounds and explain the IR absorption differences. (2% each)



- What is coupling constant in ^1H NMR spectrum? Explain the mechanism of proton-proton coupling. (5%)
 - Compare the values of the following coupling constants (J , in Hz) by orbital overlap. (5%)

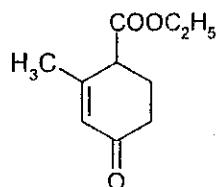


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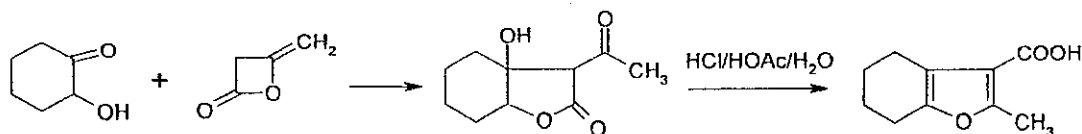
科目： 有機化學 海資所 丁組

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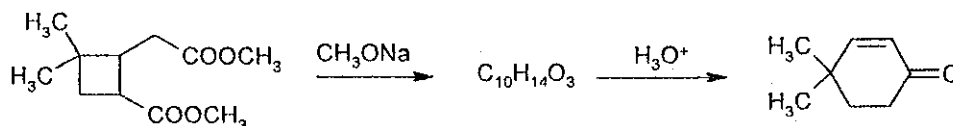
6. The following ester is formed in good yield when formaldehyde, acetone and ethyl acetoacetate are allowed to react with weak bases. Explain the steps in this conversion with structures. (6%)



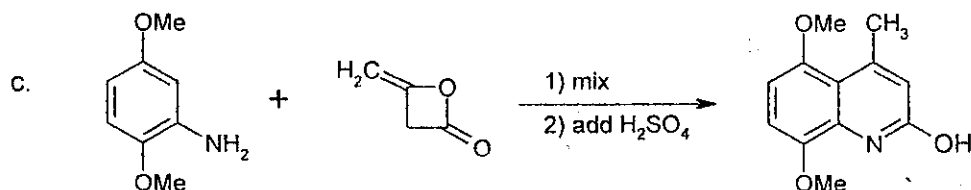
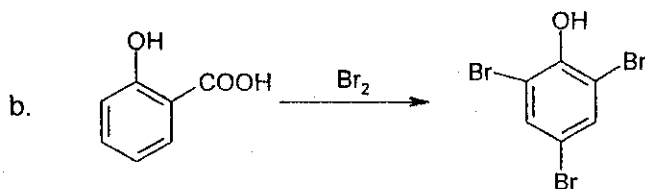
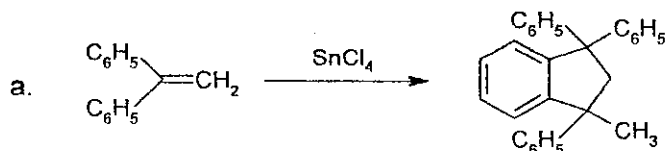
7. Write out a detailed stepwised mechanism for: (10%)



8. Account for the following observation: (6%)



9. Formulate reasonable mechanisms for each of the following reactions: (5% each)



10. Explain the following terms: (3% each)

- Enantiomers
- Diastereomers
- Chiral center
- Grignard reagent
- Wittig reaction