

- 一、細胞大小的決定因子有哪些，並詳述其理由。(10分)
- 二、請詳述由低等到高等生物的神經訊息傳遞體系的演進。(20分)
- 三、繪圖說明人與魚之 cardiovascular system (心臟血管系統) 的異同。(20分)
- 四. (10%) What is the percentage of dry weight for DNA, RNA, protein, total macromolecules and amino acids of a cell? (hint: 96, 50, 20, 3 and 0.5)
- 五. (10%) a) Please draw the general chemical structure of an  $\alpha$ -amino acid.  
b) Please name and draw the chemical structures of any five  $\alpha$ -amino acids.
- 六. (10%) What is the chemiosmosis theory proposed by Peter Mitchell in 1961?
- 七. (10%) Please describe the types and mechanisms of membrane transporter proteins.
- 八. (10%) What is the purpose and experimental procedures for the hybridoma technique?

# 國立中山大學 97 學年度碩士班招生考試試題

科目：生理學【海資系碩士班甲組選考】

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- 一、何謂生理時鐘 (biological clock)，(5 分)。請詳述生理時鐘的控制機制。(20 分)
- 二、請詳述人體的 pH 值如何保持恆定。(20 分)
- 三、繪圖說明神經細胞、心肌細胞、心臟竇房結 (SA node) 的細胞，產生動作電位 (Action potential) 機制的異同與其生理意義。(30 分)
- 四、請詳述人體控制滲透壓 (Osmolarity) 恆定的生理機制。(25 分)

**Part I (each 10 points)**

1. What are the functions of chaperones and chaperonin ?
2. Describe the structure, biological functions and differences of proteoglycans and glycoprotein.
3. What is posttranslational modification ? Describe the important of protein function in eukaryotic cell.
4. Describe the pathway of biosynthesis of membrane phospholipids ? What factors can affect membrane fluid ?
5. What is Materix-Assisted Laser Desorption/Ionization Time of Flight Mass spectrometer ? How can this instrument be used to detect protein sequence ?
6. Show the pathway by which propionyl-CoA can be converted into a citric acid cycle intermediate. Indicate where any cofactors participate.
7. What is the function of the malate-aspartate shuttle? Why ?

**Part II (each 5 points)**

1. protein microarray
2. ATP bind cassette protein (ABC)
3. Trans fat
4. protein domain
5. Nucleotide and Nucleoside
6. GPCR

# 國立中山大學 97 學年度碩士班招生考試試題

科目：生態學【海資系碩士班乙組】

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## 一. 解釋名詞(30%)(每題5分)

1. Bottom-up control
2. Edge effect
3. Microbial loop
4. *r*-selection
5. Disclimax
6. Thermocline

## 二. 簡答題 (18%)(每題3分，答題請勿超過30字，每多一字扣0.5分)

1. 物質和能量在生態系傳輸的差異為何？
2. 現代導致物種滅絕的三大原因為何？
3. 影響動物勢力圈(Territory)範圍大小的三個主要因素為何？
4. 營養物質在寒帶及熱帶的循環趨向有何不同？
5. 請比較卵生、卵胎生、及胎生動物對子代之產量及保護性大小為何？
6. 請將下列各生態系依其平均基礎生產量(Primary production)大小順序排列。  
1). Desert, 2). Tundra, 3). Coral reefs, 4). Estuaries, 5). Boreal forest

## 三. 問答題 (52%)

1. 請問“景天酸代謝光合作用(CAM photosynthesis)”是哪一類植物所特有？並請敘述其代謝機制為何？(10分)
2. 請列舉五個具體事件說明氣候變遷或地球暖化對台灣地區所造成之生態異常現象或生物多樣性之衝擊 (15%)
3. 請舉例說明六種瀕臨絕種動物的特色為何？(12分)
4. 請比較海洋生態系“Regenerated production”及“New production”之差異性為何？其對於海域生態資源或漁獲產量有何影響？(15分)

(25%) 1. 海洋牧場飼養海驢，過去幾年收成時平均體重為每尾 3.8 公斤。今年牧場主人將 49 尾海驢以新飼料餵養，假設這 49 尾海驢為現在以及未來所有以此新飼料餵養的海驢族群的一個隨機樣品，

(a) 請用以下由樣品所得到的數據，測試以新飼料餵養的海驢族群平均每尾體重大於 3.8 公斤的假說。樣品平均體重為每尾 ( $\bar{Y}$ ) = 3.9 公斤，標準偏差 (s, standard error) = 0.7 公斤。  $\alpha = 0.01$ . (15%)

(b) 假設新飼料餵養的海驢族群，收成時體重為常態分布 (Normal distribution)，且已知收成時海驢族群體重平均為每尾 3.95 公斤，標準偏差為 0.7 公斤，請問犯第二類錯誤 (Type II error) 的機率 ( $\beta$ ) 為多少？ (10%)

(16%) 2. 今隨機取樣某種魚 9 條，分析每條魚背部及腹部汞含量，得結果如下。請問此種魚之族群，其背部及腹部汞含量是否相同？ ( $\alpha = 0.05$ ) (16%)

背部：	12	15	10	9	11	15	16	13	14
腹部：	15	13	17	14	16	18	16	15	18

(14%) 3. 海洋學家調查台灣周遭海域束毛藻 (*Trichodesmium spp.*) 密度，總共比較 6 個海域，每個海域採 5 個海水樣品，得到樣品平均束毛藻密度 (trichomes per liter) 如 Table 1。

Table 1:

海域	樣品平均值
1	505
2	528
3	564
4	498
5	600
6	470

請回答 Table 2 內 a-g 各項 (答案請寫在答案卷上) (14%)

Table 2:

變異原因 (Source of variation)	SS (Sum of square)	df (Degrees of freedom)	MS (Mean square)	F
海域間	<b>a</b>	<b>b</b>	<b>e</b>	<b>g</b>
海域內	58824	<b>c</b>	<b>f</b>	
合計	115184	<b>d</b>		

(20%) 4. 以下 Table 3 摘自海洋學期刊 *Limnology and Oceanography* (於 2004 年出版, 第 49 期, 1928 頁). 由此表之內容, 請下結論。(20%)

Table 3. ANOVA results for water chemistry: comparing dissolved inorganic nitrogen (DIN) and soluble reactive phosphorus (SRP) between ambient samples and enriched samples (treatment) every 3 days (time) after enrichment on day 1 between sites (SC and PIN),  $n=3$ . Significance at  $\alpha=0.05$  is indicated in boldface type; Tr, treatment.

Factor	DIN		SRP	
	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
Site	0	0.984	0.59	0.452
Treatment	48.63	< <b>0.001</b>	15.68	<b>0.001</b>
Time	10.35	<b>0.001</b>	1.44	0.257
Site x Tr	1.60	0.218	2.15	0.157
Site x time	0.15	0.861	3.59	<b>0.044</b>
Tr x time	28.86	< <b>0.001</b>	0.54	0.592
Site x Tr x time	0.36	0.699	0.48	0.625

(25%) 5. 有一研究探討魚冷凍時間與魚品質間之關係。實驗取剛捕獲的 10 尾同種同大小的魚進行, 其中 2 尾捕獲後立即冷凍 (即 storage time 為 0 hr), 2 尾捕獲後 3 小時再冷凍, 分別在捕獲後 6, 9, 12 小時各有 2 尾冷凍。魚品質 (以 10 分為滿分) 在貯存後 7 天拿出來評量, 數據如下:

	Storage time (hr)				
	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	

某甲針對此數據進行冷凍時間與魚品質間之相關係數 (correlation coefficient,  $r$ ) 計算, 得到  $r = -0.984$ ;

某乙針對此數據進行冷凍時間 (X) 與魚品質 (Y) 間之直線迴歸分析 (Linear regression analysis), 得到迴歸直線之截距 (intercept, 為 8.46) 及斜率 (slope, 為  $-0.142$ ). 其 ANOVA (analysis of variance) 結果如下:

SOV (Source of variation)	SS (Sum of square)	df (Degrees of freedom)	MS (Mean square)	F-value
Regression	3.612	1	3.612	248.069
Residual	0.117	8	0.015	
Total	3.729	9		

(a) 請針對某甲與某乙之兩種分析結果, 分別下結論並說明得到此結論之原因。(15%)

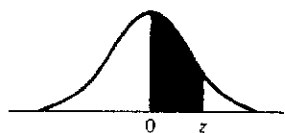
(b) 請比較某甲與某乙之兩種分析結果, 提供什麼 “相似” 及 “相異” 之訊息。(10%)

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附表 1. 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	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4990	.4990	.4990

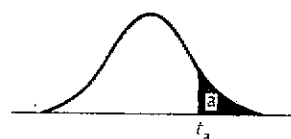
附表 3. Percentage points of the F distribution



Degrees of freedom (a = .05)

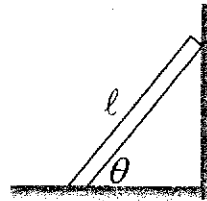
df <sub>1</sub> \ df <sub>2</sub>	1	2	3	4	5	6	7	8
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82
6	5.99	5.14	4.76	4.53	4.39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

附表 2. Percentage points of the t distribution

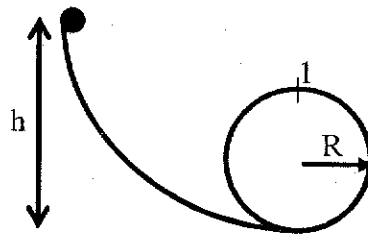


df	a = .10	a = .05	a = .025	a = .010	a = .005
1	3.078	6.314	12.706	31.821	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
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

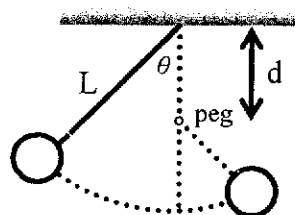
1. (10%) A uniform ladder of length  $\ell$  and mass  $m$  rests against a smooth, vertical wall. If the coefficient of static friction between ladder and ground is  $\mu_s = 0.40$ , find the minimum angle  $\theta_{\min}$  such that the ladder does not slip.



2. (15%) What mass of steam initially at  $130^\circ\text{C}$  is needed to warm 200 g of water in a 100-g glass container from  $20.0^\circ\text{C}$  to  $50.0^\circ\text{C}$ ? (Specific heat  $c$ , glass :  $837 \text{ J/kg}^\circ\text{C}$ , steam :  $2010 \text{ J/kg}^\circ\text{C}$ ) (Latent Heats of vaporization, water :  $2.26 \times 10^6 \text{ J/kg}$ )
3. (10%) A bead slides without friction around a loop-the-loop. The bead is released from a height  $h=3.5R$ . (a) What is its speed at point 1? (b) How large is the normal force on it if its mass is 5.00g?



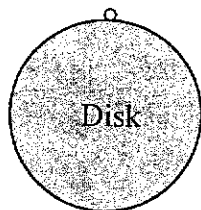
4. (10%) A pendulum, comprising a string of length  $L$  and a small sphere, swing in the vertical plane. The string hits a peg located a distance  $d$  below the point of suspension. If the pendulum is released from the horizontal position ( $\theta=90^\circ$ ) and is to swing in a complete circle centered on the peg, what is the minimum value of  $d$ ?



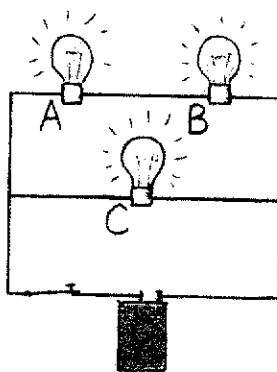
5. (10%) A hydrogen atom makes a transition from the  $n=2$  state to the ground state (corresponding to  $n=1$ ). Find the wavelength and frequency of the emitted radiation.



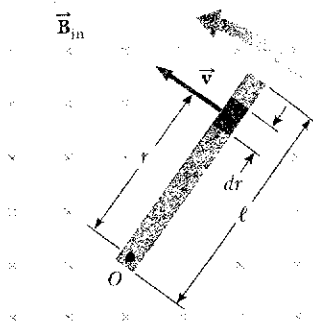
6. (15%) A circle disk of mass  $M$  and radius  $R$  is hung on a nail from a small loop located at one edge. After it is placed on the nail, the sign oscillates in a vertical plane. Find the period of oscillation if the amplitude of the motion is small.



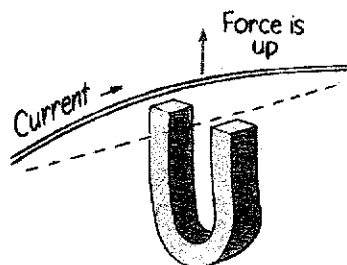
7. (10%) (a) How do the brightnesses of the identical lightbulbs compare? (b) Which bulb draws the most current? (c) What will happen if bulb A is unscrewed? And (d) if bulb C is unscrewed?



8. (15%) A conducting bar of length  $\ell$  rotates with a constant angular speed  $\omega$  about a pivot at one end. A uniform magnetic field  $B$  is directed perpendicular to the plane of rotation as in Figure. Find the emf induced between the ends of the bar.



9. (5%) In the following magnet, point out the "N" pole, and the "S" pole in your answer sheet.



# 國立中山大學 97 學年度碩士班招生考試試題

科目：普通地質學【海資系碩士班丙組選考】

共 1 頁 第 1 頁

## 一、解釋名詞（15%，每小題 3 分）

- 1、plunging fold
- 2、thrust fault
- 3、weathering
- 4、uniformitarianism
- 5、lava

## 二、簡答題（30%，每小題 6 分）

- 1、鑽石和石墨的成分都是碳，為什麼石墨摸起來很滑很軟，而鑽石卻是最堅硬的礦物？
- 2、岩石之分類主要是依據岩石所具有的甚麼性質？試以變質岩為例說明之，並寫出主要的變質岩名稱。
- 3、台灣地區有很多會自然冒出地下水的水井，稱為自流井（artesian well），試繪圖說明自流井是如何形成的。
- 4、根據研究，在地質年代中的白堊紀（Cretaceous）與第三紀（Tertiary）的界限上曾經發生物種（包括恐龍）大量滅絕的事件，請問目前的研究資料顯示這個滅絕事件是由什麼原因所造成，又其所根據的主要證據是什麼？
- 5、日常生活中常用到的鋁（aluminum）主要是來自什麼礦物？這種含鋁量很高的礦物是經由何種地質作用所產生的？

## 三、問答題（55%，每小題 11 分）

- 1、(a)試敘述火山作用對人類的好處與壞處，(b)台灣本島上哪裡有火山作用或者火山作用的遺跡？並簡述這些火山作用所形成火山岩的類型以及其和板塊構造運動的關係。
- 2、試敘述台灣地區主要的地質災害的種類、特性、與可能的防治之道。
- 3、試以碳（C）的循環作例子，說明地球四大圈層--氣圈、水圈、岩石圈、與生物圈之間的密切關連性。
- 4、請繪出一個以大西洋的中洋脊為中心，涵蓋南美洲到南美洲西岸（包括太平洋東南側洋殼）以及非洲西岸之東西向橫斷剖面圖，並於圖上標示清楚各個板塊與板塊界線之名稱、以及各區可能伴隨發生之地質作用名稱。
- 5、(a)試繪圖說明地球的內部構造與特性，(b)請問哪些方法或材料可以用來研究和瞭解地球內部的構造和性質？

# 國立中山大學 97 學年度碩士班招生考試試題

科目：微積分【海資系碩士班丙組選考】

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共十題，每題10分。答題時，每題都必須寫下題號與詳細步驟。  
請依題號順序作答，不會作答題目請寫下題號並留空白。

1. An oil-storage tank is built in the form of an inverted right-circular cone with a height of 6 m and a base radius of 2 m. Oil is pumped into the tank at a rate of 2 liters (L)/min = 0.002 m<sup>3</sup>/min (since 1 m<sup>3</sup> = 1000 L). How fast is the level of the oil rising when the tank is filled to a height of 3 m?
2. Calculate the derivative of the function  $G(u) = \int_{2u}^{u^2} x^2(1+x^3)^4 dx$  at  $u_0 = -1$ .
3. Find the volume of the solid generated by rotating the region bounded by the given curves and lines  $y = 3x + 2$ ,  $x = 0$ ,  $y = 0$ ,  $x = 2$  about the  $y$ -axis.
4.  $\int \frac{x^3}{x^4 - 8x^2 + 16} dx$
5. Find the area of the region enclosed by the small loop of the limaçon  $r = 3 - 4 \cos \theta$ .
6. Find the maximum  $p$  such that

$$\lim_{x \rightarrow 0} \frac{\cos x - 1}{x^p}$$

exists and is finite.

7. Evaluate

$$\frac{1^2}{0!} + \frac{2^2}{1!} + \frac{3^2}{2!} + \frac{4^2}{3!} + \dots$$

8. Find the radius of convergence and interval of convergence of the power series  $\sum_{k=0}^{\infty} 2^k(x-4)^k / \ln(k+2)$ .
9. Find the maximum value and point of  $w = xyz$  among all points  $(x, y, z)$  lying on the line of intersection of planes  $x + y + z = 30$  and  $x + y - z = 0$ .
10. Find the volume of the solid bounded by  $xy$ -plane, the cylinder  $x^2 + y^2 = 4$ , and the paraboloid  $z = 2(x^2 + y^2)$ .

# 國立中山大學 97 學年度碩士班招生考試試題

科目：流體力學【海資系碩士班丙組選考】

共 / 頁 第 /

## 一、簡答題 (30 分)

- (1) 皮托管(Pitot tube)的測量原理為何?
- (2) 文氏管(Venturi tube)的測量原理為何?
- (3) 紊流與層流的發生是依據哪一個參數的大小來決定?
- (4) 自由表面(如 波浪)的主要控制參數為何者?
- (5) 當進行模型試驗時，若欲獲得完全之相似性，需滿足那些條件?
- (6) 何謂 Lagrangian 及 Eulerian 對流動之描述方式?
- (7) 何謂牛頓流體?並舉一例。
- (8) 若流場為不可壓縮流時，則連續方程式可簡化成怎樣?
- (9) 在判斷一流體運動是否具有可壓縮性之最重要參數為何者?
- (10) 機翼之攻角與升力如何定義?試繪圖說明升力係數與攻角之關係。

## 二、The velocity component of a steady flow field are $u=2xy$ and $v=4+x^2-y^2$ , (20 分)

- (1) Is the flow incompressible?
- (2) Is the flow rotational or irrotational?
- (3) Find the velocity potential?
- (4) Find the stream function?

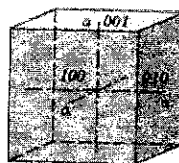
## 三、有一石塊在空氣中重為 441N，在水中重為 245N，試求石塊之體積及其比重。(15 分)

## 四、若渠道水流發生水躍現象(hydraulic jump)，水躍前後之水深分別為 0.9 m 及 3.6 m，渠道寬為 50 m，試求渠道之流量。(20 分)

## 五、一浸沒於流體中的物體所受之力 $F$ 隨著下列參數而改變:物體長度 $L$ ，流體密度 $\rho$ ，流體黏滯係數 $\mu$ ，流動速度 $V$ ，亦即 $F=f(L, V, \rho, \mu)$ ，利用無因次分析方法將其無因次化。(15 分)

一、簡答題 (30%，每小題 6 分，共 5 小題)

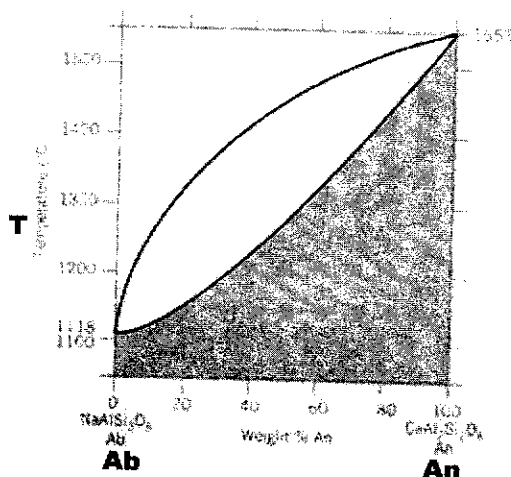
- 1、何謂礦物 (minerals)？請述明礦物之定義。
- 2、礦物係根據什麼性質來分類？試以一個礦物種名—普通輝石 (augite) 為例，說明其在分類上所依屬之礦物族群。
- 3、下圖為一個正六面體 (cube)，請寫出其所擁有對稱元素之種類與數量，並繪圖標示出這些對稱元素的位置。



- 4、在礦物學的發展史上一個很重要的發現與進展是在 1912 年時由勞厄 (Max von Laue) 所提出的想法，並由佛拉德烈 (Friedrich) 與克尼平 (Knipping) 所完成的一項實驗，這項實驗得到什麼結果？此結果又驗證了什麼？
- 5、下列符號分別代表什麼意義：
  - (a)  $(hkl)$ ，(b)  $\{hkl\}$ ，(c)  $[uvw]$ ，

二、問答題 (70%，每小題 10 分，共 7 小題)

- 1、(a) 藉由觀察晶體的晶形 (crystal form) 可以鑑別的對稱性質是屬於外部對稱，晶體的對稱元素中有哪些是屬於外部對稱？(b) 又有哪些對稱元素是屬於晶體的內部對稱？要用什麼方法才可以判斷晶體的內部對稱？
- 2、(a) 鑑定礦物常用的物理性質包括解理 (cleavage) 和硬度 (hardness)，試分別說明什麼是解理和硬度？(b) 請分別舉出具有良好一組解理、兩組解理、和三組解理之礦物各一種。(c) 摩氏硬度表中硬度為三、五、和七的代表性礦物分別是什麼礦物？
- 3、下圖為一個兩成份相圖 (phase diagram)，兩個端成份分別為 Albite (Ab) 和 Anorthite (An)，試回答下列問題：(a) 於答案卷上簡繪此圖，並於其上標示以下資訊：(1) 單一液相區、(2) 單一固相區、(3) liquidus、(4) solidus、(5) 兩相區，(b) 請說明這個圖的意義。



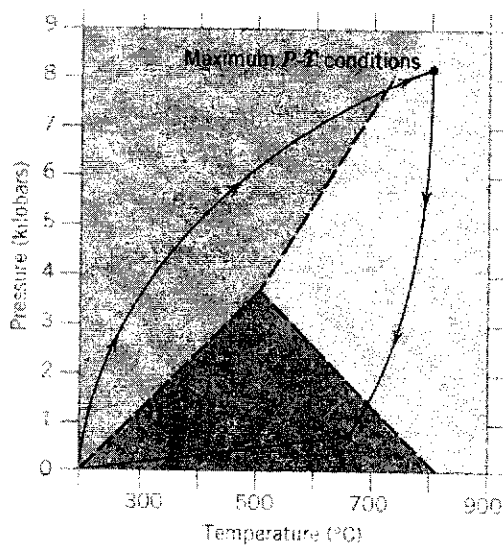
# 國立中山大學 97 學年度碩士班招生考試試題

科目：礦物學【海資系碩士班丙組選考】

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第 2 頁，共 2 頁

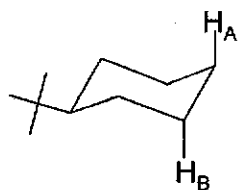
- 4、成份為  $\text{Al}_2\text{SiO}_5$  之礦物有三種同份異構物 (polymorphs)，(a) 請寫出此三種同份異構物之礦物名稱，(b) 下圖為此三種同份異構物在單一成分系統的壓力-溫度圖上之平衡曲線 (粗線段)，請比照繪出此簡單相圖，並標明此三種同份異構物分別之位置，討論此三種同份異構物分別產出於不同的岩石中時所指示之地質環境。



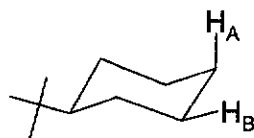
- 5、下列兩個符號分別代表什麼意義 (從中可以分別獲得晶體的哪些性質或訊息)：(10%)  
(a)  $2/m 2/m 2/m$ ，(b)  $I 432$
- 6、有一長石 (feldspar) 晶體，經由化學分析知其化學成份為  $\text{SiO}_2 = 65.90\%$ ， $\text{Al}_2\text{O}_3 = 19.45\%$ ， $\text{Fe}_2\text{O}_3 = 1.03\%$ ， $\text{CaO} = 0.61\%$ ， $\text{Na}_2\text{O} = 7.12\%$ ， $\text{K}_2\text{O} = 6.20\%$  (重量百分比)，試計算此長石之化學式 (需寫出計算過程，原子量  $\text{O} = 16.0$ ， $\text{Si} = 28.1$ ， $\text{Al} = 27.0$ ， $\text{Fe} = 55.8$ ， $\text{Ca} = 40.1$ ， $\text{Na} = 23.0$ ， $\text{K} = 39.1$ )。
- 7、(a) 根據矽氧四面體的排列與連結情形，矽酸鹽類礦物可以分為哪幾種類型？(b) 寫出各類型矽酸鹽類礦物之代表性礦物名稱各一種。

1. Draw structures for the following compounds. (3% each)
  - a. 3-Amino-1-cyclopentene
  - b. 3-Methyl-3-ethyl-1-pentyne
  - c. *p*-Chlorobenzoic acid
  - d. 2-Butyl-4-methylpentanoate
  - e. 3-Carboxycyclobutene
  - f. Hex-1-en-3-one-4-ol
  
2. Explain the following terms. (3% each)
  - a. Grignard reagent
  - b. Wittig reaction
  - c. Chiral center
  - d. Enantiomers
  - e. Diastereomers
  - f. Aldol condensation
  - g. Claisen condensation
  - h. Electrophilic aromatic substitution
  - i. Racemic modification
  - j. Reformatsky reaction
  
3. Write structures for compounds that belong in the following classes. (3% each)
  - a.  $\beta,\gamma$ -Unsaturated- $\delta$ -lactone
  - b. Cyclic unsaturated anhydride
  - c. Oxime of an aromatic ketone
  - d.  $\gamma$ -Diketone
  - e. Semicarbazole
  
4. In a  $^1\text{H}$  NMR spectrum,
  - a. The number of peaks ( $N$ ) into which a proton signal is split equals one more than the number of vicinal protons ( $n$ ):
 
$$N = n + 1 \quad N = 2 \text{ (one vicinal H)} = \text{doublet (1:1)}$$

$$N = 3 \text{ (two vicinal H)} = \text{triplet (1:2:1)}$$
 Explain this by the spin states of neighboring protons. (5%)
  - b. What is coupling constant? Explain the mechanism of proton-proton coupling. (5%)
  - c. Compare the values of the following coupling constants ( $J$ , in Hz) by orbital overlap. (6%)

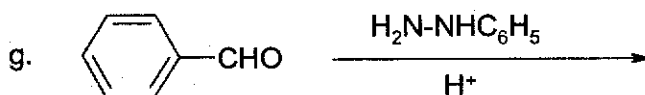
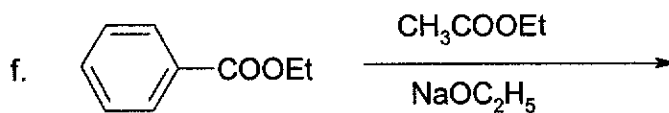
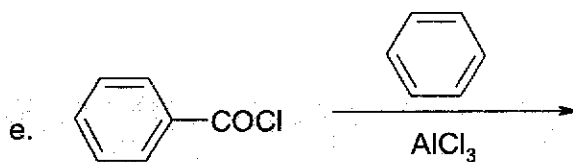
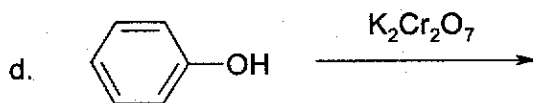
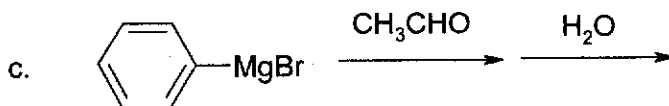
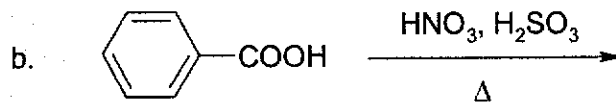
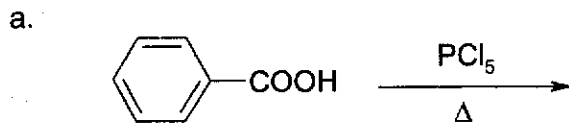


$$J_{AB} = 11-14 \text{ Hz}$$



$$J_{AB} = 4-5 \text{ Hz}$$

5. Give the expected major product for the following reactions. (3% each)





# 國立中山大學 97 學年度碩士班招生考試試題

科目：分析化學【海資系碩士班丁組】

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- (10%) 1. Distinguish between the term end point and equivalence point in a titration.
- (10%) 2. Calculate the pH of (a)  $1.0 \times 10^{-3}$  M HBr; (b)  $1.0 \times 10^{-2}$  M KOH.
- (10%) 3. Write the  $K_b$  reaction of  $\text{CN}^-$ . Given that the  $K_a$  value of HCN is  $6.2 \times 10^{-10}$ , calculate  $K_b$  for  $\text{CN}^-$ .
- (10%) 4. Consider a saturated solution of  $\text{R}_3\text{NH}^+\text{Br}^-$ , where R is an organic group. Find the solubility (M) of  $\text{R}_3\text{NH}^+\text{Br}^-$  in a solution maintained at pH 9.
- $$\text{R}_3\text{NH}^+\text{Br}^-_{(s)} \rightleftharpoons \text{R}_3\text{NH}^+ + \text{Br}^- \quad K_{sp} = 8.0 \times 10^{-8}$$
- $$\text{R}_3\text{NH}^+ \rightleftharpoons \text{R}_3\text{N} + \text{H}^+ \quad K_a = 10^{-9}$$
- (10%) 5. Explain the principle of operation of ion-selective electrodes.
- (10%) 6. Explain the difference between transmittance, absorbance, and molar absorptivity. Which one is proportional to concentration?
- (10%) 7. What is the difference between fluorescence and phosphorescence?
- (10%) 8. State the advantages and disadvantages of a furnace compared with a flame in atomic absorption spectroscopy.
- (10%) 9. A solute with a partition coefficient of 4.0 is extracted from 10 ml of phase 1 into phase 2.
- (a) What volume of phase 2 is needed to extract 99% of the solute in one extraction?
- (b) What is the total volume of solvent 2 needed to remove 99% of the solute in two equal extractions instead?
- (10%) 10. Why does a thermal conductivity detector respond to all analysts except the carrier gas? Why isn't the flame ionization detector universal?