國立中山大學九十一學年度碩士班招生考試試題

科目：普通生物学（海資所）（甲組）

1. How do prokaryotic and eukaryotic cell differ? How are they similar? What are the current hypothetical models for eukaryotic origins? 20%

2. How can parthenogenesis, hermaphroditism and sequential hermaphroditism be distinguished from one another? What advantages do animals with reproduction cycle have and to what are these cycles usually related? 20%

3. What is an intertidal zone? What causes the zonation evident in a rocky intertidal zone? What special adaptations are found in intertidal zone organisms? 10%

4. 繪圖說明細胞膜的構造。 15%

5. 繪圖說明人、硬骨魚、蚯蚓之循環系統。 20%

6. 繪圖說明神經細胞（Neuron）產生動作電位（action potential）之離子機制。 15%

國立中山大學九十一學年度碩士班招生考試試題

科目：生理學（海資所）（甲組選考）

1. 詳述細胞的靜止膜電位（resting membrane potential）形成的機制。 20%

2. 繪圖詳述神經網路中之電傳導突觸（electrical synapse）和化學傳導突觸（chemical synapse）。 30%

3. 詳述下視丘-腦下垂體-腎上腺軸（hypothalamic-pituitary-adrenal axis）之作用機制及其生理功能。 30%

4. 詳述血紅素和氧鍵結量的影響因子及其作用機制。 20%

Ten points for each question, except otherwise indicated.

1. Peter Mitchell proposed the chemiosmotic hypothesis in 1961. What is it?

2. Predict the relative rates (fast, intermediate or slow) of hydrolysis and products by lysozyme of these oligosaccharides (G stands for an N-acetylglucosamine residue, and M for N-acetylmuramic acid):
(a) M-M-M-M-M-M
(b) G-M-G-M-G-M
(c) M-G-M-G-M-G

3. What is the Pasteur effect? Which enzyme and how it is affected?

4. (20%) What components or ingredients are required for DNA synthesis? Name at least three techniques that utilize the knowledge of DNA synthesis.

5. What are the two Mendelian principles and how can these principles be explained in terms of mitosis.

6. Name the DNA repair systems in *Escherichia coli.*

7. What is the approximate net charge of the peptide at pH 7.0? Assuming that its side chains have the p*K* values given in the table and that the p*K*s of the terminal $-NH_3^+$ and –COOH groups are 7.8 and 3.6, respectively.

Ser-Tyr-Ser-Met-Glu-His-Phe-Arg-Trp-Gly-Lys-Pro-Val-Gly-Lys-Lys-Arg-Arg-Pro-Val-Lys-Val-Tyr-Pro-Asp-Ala-Gly-Glu-Asp-Gln-Ser-Ala-Glu-Ala-Phe-Pro-Leu-Glu-Phe

p*K* values of some amino acids

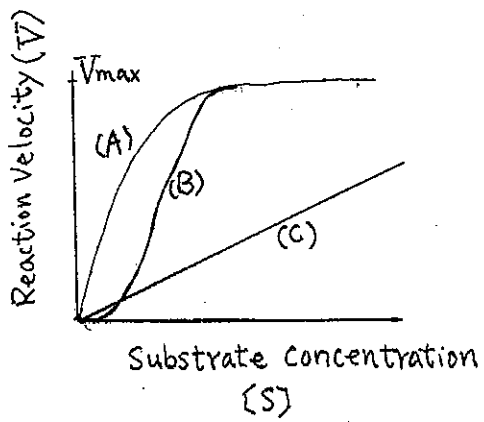
Amino acid	*pK values (25°C)*		
	α-COOH group	*α-NH_3^+ group*	*Side chain*
Alanine	2.3	9.9	
Glycine	2.4	9.8	
Phenylalanine	1.8	9.1	
Serine	2.1	9.2	
Valine	2.3	9.6	
Aspartic acid	2.0	10.0	3.9
Glutamic acid	2.2	9.7	4.3
Histidine	1.8	9.2	6.0
Cysteine	1.8	10.8	8.3
Tyrosine	2.2	9.1	10.9
Lysine	2.2	9.2	10.8
Arginine	1.8	9.0	12.5

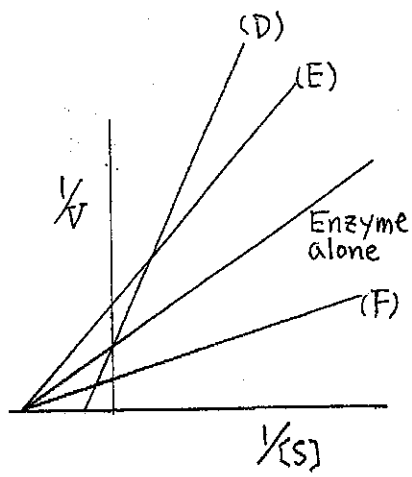
8. Identify the effects of the following mutations of *E. coli* in swimming behavior as; non-motile, swims (without tumbling) or tumbles

(a) *che* Y
(b) *che* Z
(c) *che* A
(d) *che* B
(e) *che* W

9. Based on the graphs below, please identify the curves or lines for

(i) solitary enzyme
(ii) allosteric enzyme
(iii) enzyme with competitive inhibitor
(iv) enzyme with non-competitive inhibitor





A double-reciprocal plot of enzyme kinetics

國立中山大學九十一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 ）

一、 選擇題 (50 %, 單選, 答對得 2 分, 答錯倒扣 1 分)（答案請填寫於答案卷上）

1. Which of the following does not appear to be an important biotic controlling factor of zonation in the rocky intertidal?
(1) Parasitism, (2) Competition, (3) Predation. (4) Grazing, (5) Larval settlement.

2. In the rocky intertidal zone which one of the following resources is in limited supply?
(1) Food, (2) Mates, (3) Space, (4) Oxygen.

3. Which of the following features is the major contributor to zonation in sandy beaches?
1. Space, 2. Wave action, 3. Competition, 4. Particle size, 5. Predation, 6. Beach slope.
(1) 1 and 2, (2) 3, 4, and 5, (3) 2, 4 and 6, (4) 4, 5, and 6, (5) 1, 3, and 5.

4. As one proceeds from an oxidized zone through the RPD layer and into the anoxic zone the color of the mud changes from _____. (1) gray to black to brown. (2) brown to black to gray. (3) gray to brown to black. (4) brown to gray to black.

5. The major predator on mud flats are _____. (1) fish and birds, (2) fish and crabs, (3) fish and snails, (4) snails and birds, (5) crabs and snails.

6. A central theme in marine ecology is that whenever predation is reduced _____.
(1) densities are reduced, (2) competition is increased, (3) competition is decreased, (4) grazing pressure is decreased.

7. An osmoconforming organisms is one is which _____. (1) The animal conforms to the contours of the substratum. (2) the mechanism to control the salt content is poorly developed. (3) the animal does whatever the other animals surrounding it does. (4) the mechanisms to control the salt content is highly developed.

8. Which of the following statements is not true ?
(1) About 71 percent of the surface of this planet is covered by salt water.
(2) The average depth of ocean is 3.8 km, giving a volume of 1370×10^6 km^3.
(3) Seawater is slightly alkaline, usually pH ranging from 7.5 to 8.4.
(4) The oceans are equally distributed over the earth.
(5) There are organisms living in 85°C hot springs.

9. Which of the following ions is not the major constituents of seawater ?
(1) Magnesium. (2) Sulfate. (3) Potassium. (4) Bicarbonate. (5) Calcium

10. Which of following oceans is the largest in the world ?
(1) South China Sea. (2) Atlantic Ocean. (3) Pacific Ocean.
(4) North Sea. (5) Indian Ocean.

11. The two most abundant inorganic ions in seawater are _____ and _____.
(1) calcium, potassium, (2) chlorine, magnesium, (3) calcium, sodium, (4) sodium, chlorine, (5) chlorine, sulfate.

12. Pure water absorbs which of the following colors of light the most rapidly ?
(1) Red, (2) Orange, (3) Yellow, (4) Blue, (5) Green.

13. The deep, flat bottom of the ocean floor is know as the _____.
(1) continental slope, (2) submarine ridge, (3) abyssal plain, (4) continental rise, (5) oceanic ridges.

14. The zone of rapid temperature decline with depth is known as the _____.
(1) Gyre, (2) Rings, (3) Eddies, (4) Thermocline.

15. Which of following biological oceanographic expeditions is the pioneer ?
(1) *Princess Alice*, (2) *Discovery* I, (3) *Challenger*, (4) *Alvin*, (5) *National*.

16. Which of following habitat types comprised the smallest portion of ecological oceanic area?
(1) Continental slopes, (2) Continental shelves, (3) Oceanic trench,
(4) Littoral zones, (5) Abyssal plains.

17. Which level of ecology considers energy flow and chemical cycling?
(1) community. (2) ecosystem. (3) organism. (4) population. (5) cell.

18. Upwelling in the ocean (1) are locations of reef communities. (2) occur over deep-sea hydrothermal vents. (3) are responsible for ocean currents. (4) bring nutrient-rich water to the surface. (5) are the r water currents in tropical area.

19. When one species was removed from a tidepool. The species richness became significantly reduced. The removed species was probably (1) a strong competitor. (2) a potent parasite. (3). a resource partitioner. (4) a decomposer. (5) a keystone predator.

20. Phytoplankton are the basis of the food chain in (1) wetlands. (2) the oceanic pelagic biome. (3) rocky intertidal zones. (4) deep-sea thermal vents. (5) rain forest.

21. Where is "red tide" most likely to occur? (1) headwaters of a stream. (2) downstream area of a river. (3) open ocean. (4) intertidal zone of an ocean. (5) red sea.

22. The species richness of a community refers to (1) the relative numbers of individuals in each species. (2) the number of different species found in a community. (3) the feeding relationships or tropic structure within the community. (4) the ability to persist through disturbances.

23. In a mark-recapture study of a sea bream population, 1000 fish were captured, marked, and released. In a second capture, 200 fish were captured; 2 of these were marked. What is the estimated number of individuals in the sea bream populations?
(1) 20000. (2) 100000. (3) 200000. (4) 40000.

24. The concept of trophic structure of a community emphasizes the (1) prevalent form of vegetation. (2) effects of coevolution. (3) feeding relationships within a community. (4) species richness of the community.

25. Which of these ecosystem has the lowest primary productivity per square meter?
(1) a salt marsh. (2) an open ocean. (3) a coral reef. (4) a grassland. (5) Rain forest.

二、 問答（50%）

1. 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？(15 %)

2. 海洋往往是人們做為各種家庭及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會有什麼樣潛在危害？我們又該如何的防患未然？(15%)

3. 請比較陸域生態系與海洋生態系的異同？ (20%)

國立中山大學九十一學年度碩士班招生考試試題

科目：生物統計學（海資碩士班）乙組

1. Please explain the following terminology:
   (a) H_0: $\mu=1$ and H_a: $\mu\neq 0.2$; What is the meaning of subscription of 0 and a of the H? (10%)
   (b) ANOVA, write the meaning in English. (10%)
   (c) μ (2%)
   (d) σ (2%)
   (e) n (2%)
   (f) SS (2%)
   (g) Significant (2%)

2. In case of a set of two repeats {1, 3}, its mean is 2.
   (a) What is the standard deviation (SD)? (1%)
   (b) To express the data, one might say 2±1 (2-1=1 for 1 and 2+1=3 for 3). However, from the statistic data, people express the data as mean±SD. Did you get the same result? Please explain it whether or not you get difference. (3%)

3. In case of a set of three repeats {1, 2, 3}, its mean is 2 again.
   (a) What is the standard deviation (SD)? (2%)
   (b) To express whole range of the data, one might say 2±1 (2-1=1 for 1 and 2+1=3 for 3). However, from the statistic data, people express the data as mean±SD. Did you get the same result? Please explain it whether or not you get difference. (4%)
   (c) Explain why the conclusion here is different from Question #2? (5%)

4. An aquaculture farmer claimed the mean size of juvenile is 1.5 inches with standard deviation of 0.1 inch.
   (a) Please calculate the percentages of fish that are not bigger than 1.2, 1.3, and 1.4 inches, respectively. (24%)
   (b) Give an example to show what required conditions should be hold for calculation of part (a). (6%)

5. In linear regression, $y=\alpha x+\beta$ is the equation. Please use the theory of "Least-Square" to prove or derive the formula to acquire the slope α and intersection β. The experiment data are $\{(x_0, y_0), (x_1, y_1), (x_2, y_2),..., (x_i, y_i), ..., (x_n, y_n)\}$. (25%)

國立中山大學九十一學年度碩士班招生考試試題

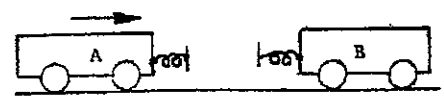
科目：普通物理（海資所）（丙組選考）

一，選擇題部份，共有十題，每題 5 分。將正確選項寫在答案卷上。

1. An object is thrown vertically into the air. Which of the following five graphs represents the velocity v of the object as a function of the time t ?

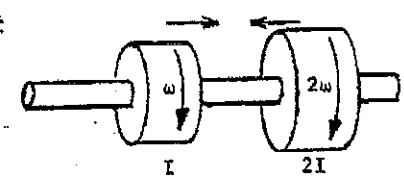
a. b. c. d. e.

2. Two carts A and B, having spring bumpers, collide as shown. Cart A has a mass of 2 kg and is initially moving to the right. Cart B has a mass of 3 kg and is initially stationary. When the separation between the carts is a minimum:



a. cart B is still at rest
b. cart A has come to rest
c. both carts have the same momentum
d. both carts have the same kinetic energy
e. the kinetic energy of the system is at a minimum

3. Two disks are mounted on low friction bearings on a common shaft. The first disc has moment of inertia I and is spinning with angular velocity ω. The second disc has moment of inertia 2I and is spinning (in the same direction as the first disc) with angular velocity 2ω as shown. The two disks are slowly forced toward each other along the shaft until they couple and have a final common angular velocity of:



a. $5\omega/3$, b. $\omega\sqrt{3}$, c. $\omega\sqrt{7/3}$, d. ω, e. 3ω

4. An object is dropped from an altitude of one earth radius above the earth's surface. If M is the mass of the earth and R is its radius, the speed of the object just before it hits the earth is given by:

a. $\sqrt{GM/R}$, b. $\sqrt{GM/2R}$, c. $\sqrt{2GM/R}$, d. $\sqrt{GM/R^2}$

e. $\sqrt{GM/2R^2}$

5. A large tank filled with water has two holes in the bottom, one with twice the radius of the other, In steady flow the speed of water leaving the larger hole is _____ the speed of the water leaving the smaller.

   a. twice, b. four times. c. half, d. one fourth, e. the same as

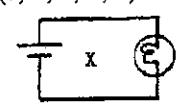
6. The displacement of a string carrying a traveling sinusoidal wave is given by $y(x,t) = y_m \sin(kx - \omega t - \phi)$. At time t = 0 the point at x = 0 has a displacement of 0 and is moving in the positive y direction. The phase constant ϕ is:

   a. 45°, b. 90°, c. 135°, d. 180°, e. 270°

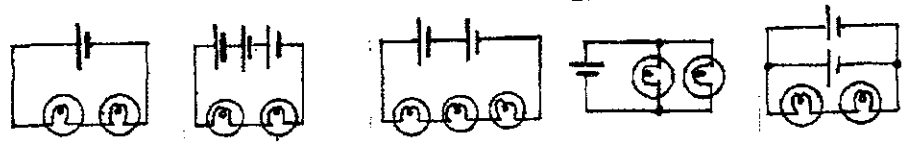
7. If the speed of sound is 340 m/s, the two lowest frequencies of an 0.5 m organ pipe, closed at one end, are approximately:

   a. 170 and 340 Hz, b. 170 and 510 Hz, c. 340 and 680 Hz
   d. 340 and 1020 Hz, e. 57 and 170 Hz

8. In the diagrams below, all light bulbs are identical and all seats of emf are identical. In which circuit (a, b, c, d, e) will the bulbs glow with the same brightness as in circuit x?

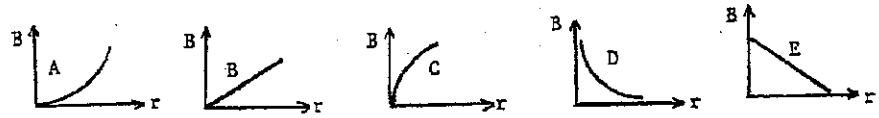


a. b. c. d. e.



9. Which graph below correctly gives the magnitude of the B field outside an infinitely long straight current-carrying wire as a function of the distance r from the wire?

a. b. c. d. e.



10. The term "virtual" as applied to an image made by a mirror means that the image:

a. is on the mirror surface,
b. can not be photographed by a camera
c. is in front of the mirror
d. is the same size as the object
e. can not be shown directly on a screen

二，計算題部份，共 5 題，每題 10 分。

1. As shown in Fig. 1, a bullet of mass m and speed v passes completely through a pendulum bob of mass M. The bullet emerges with a speed of $v/2$. The pendulum bob is suspended by a stiff rod of length ℓ and negligible mass. What is the minimum value of v such that the pendulum bob will barely swing through a complete vertical circle?

2. A siphon is used to drain water from a tank, as illustrated in Fig. 2. The siphon has a uniform diameter. Assume steady flow without friction. (a) If the distance h = 1.00 m, find the speed of outflow at the end of the siphon. (b) What is the limitation on the height of the siphon above the water surface?

3. A sphere of mass M is supported by a string that passes over a light horizontal rod of length L as shown in Fig. 3. Given that the angle is θ and that the fundamental frequency of standing waves in the section of the string above the horizontal rod is f, determine the mass of this section of the string.

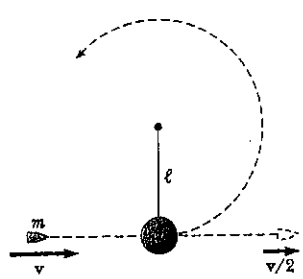


Fig. 1

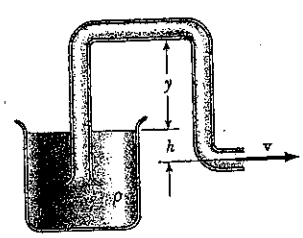


Fig. 2

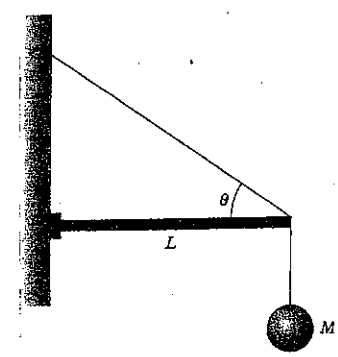


Fig.3

4. An electron moves in a circular path perpendicular to a constant magnetic field with a magnitude of 1.00 mT. If the angular momentum of the electron about the center of the circle is 4.00 x 10^{-25} J.s, determine (a) the radius of the circular path and (b) the speed of the electron.

5. If R = 1.00 kΩ and ε = 250 V in Fig. 4, determine the direction and magnitude of the current in the horizontal wire between a and e.

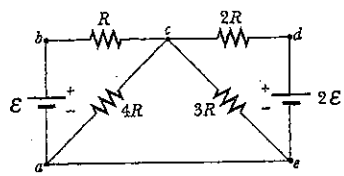
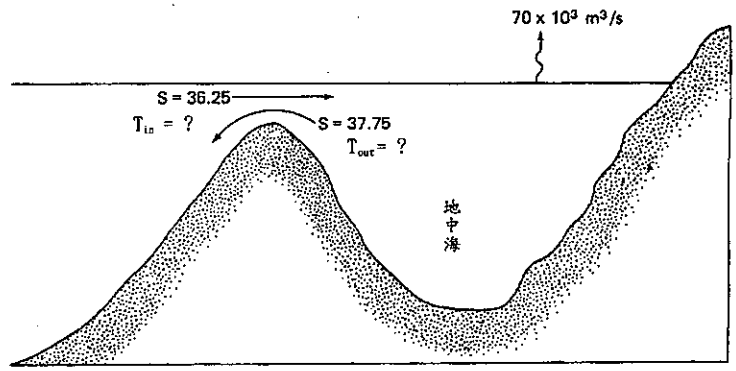


Fig. 4

國立中山大學九十一學年度碩士班招生考試試題

科目：海洋物理學(海資系碩士班)丙組選考

1.如下圖所示，地中海的體積爲 $4\times10^{15}m^3$，蒸發量爲 $70\times10^3m^3/s$，流入海水的鹽度爲 36.25，流出海水的鹽度爲 37.75，由體積守恆和鹽量守恆公式，求流入海水的流量 T_{in} 和流出海水的流量 T_{out} = ? m^3/s，另外滯留時間(residence time)是多少秒? (12 分)



2.如何由渦度守衡來解釋西方邊界流較東方邊界流強? 比較兩者的流速、寬度、深度、溫度、生產力有何不同? (12 分)

3.深水波和淺水波的定義是什麼? 相位速度(phase velocity)和波長如何表示? 繪出其水粒子運動軌跡? (12 分)

4.何謂大潮? 小潮? 調和分析? M_2 潮? 潮流橢圓? (12 分)

5.地衡流(geostrophic flow)的力平衡公式? 假設海水的鹽度分佈變化不大，在北半球，若面向洋流下游，則其海面和斜溫層斜度如何變化(可畫圖說明)? 如何由地衡方法推算洋流大小? (12 分)

6.海洋和大氣之間的熱量交換包含哪幾項? 描述每一項的意義及其大小? (12 分)

7 解釋名詞: (每小題 4 分)

(1)stratified ocean
(2)thermohaline circulation
(3)T-S curves
(4)potential temperature
(5)sound channel
(6)Ekman spiral
(7)coastal and equatorial upwelling

國立中山大學九十一學年度碩士班招生考試試題

科目：普通地質學（海資所）(兩組選考)

一、 解釋名詞（每小題 3 分，共 30 分）

1. metallic bonding
2. metamorphic Index mineral
3. sorting
4. mass wasting (mass movement)
5. magmatic differentiation
6. Precambrian
7. marine magnetic anomaly
8. epicenter
9. lithification
10. hot spot

二、 問答題（每小題 10 分，共 70 分）

1. (a)試說明為什麼現今在北美洲西岸有很多火山活動，但是在北美洲東岸卻沒有火山活動？

   (b)又為什麼小小的台灣有不少火山遺跡(如大屯山、七星山)，但是地大物博的大陸卻未見火山地形？

2. 沉積作用可以形成那些種類的礦床？並簡單說明彼等礦床之形成機制或過程。

3. 岩石之分類主要是依據岩石所具有的甚麼性質？試以火成岩為例說明之。

4. 岩石的風化作用取決於那些因素或條件，試討論之。

5. 變質作用可以分為那些類型？各有甚麼特點，試說明之。

6. 地質年代有所謂的相對年代(relative age)與絕對年代(absolute age)，請問要如何決定相對年代與絕對年代？

7. 試繪出一個包括板塊分離界線(divergent boundary)與聚合界線(convergent boundary)之板塊區域的橫斷剖面圖，並於圖上標示清楚各個地體單位、地形、以及伴隨發生之地質作用名稱。

國立中山大學九十一學年度碩士班招生考試試題

科目：微積分（海資所）（丙組選考）

1.計算極限: (10 分)

(a) $\lim_{x\to 0}\frac{\sqrt[3]{2+x}-\sqrt[3]{2}}{x}$

(b) $\lim_{x\to -\infty}\frac{-2x^4+3x^3-x+1}{x^4-x^2+1}$

2.求導函數 $f'(x)$ (10 分)

(a) $f(x)=\frac{\ln x}{x+1}$

(b) $f(x)=\frac{e^x}{x^2+1}$

3.求下列積分 (30 分)

(a) $\int\frac{5}{(5x-1)^2}dx$

(b) $\int x^2\cos x dx$

(c) $\int\sqrt{x}\ln x dx$

(d) $\int_1^{\infty}\frac{dx}{x\sqrt{x-1}}$

(e) $\int_0^1\int_0^{1-y} xdxdy$

4.判定下列級數爲收斂或發散 (10 分)

(a) $\sum_{n=1}^{\infty}\frac{4}{n+1}$

(b) $\sum_{n=1}^{\infty}\frac{\sin^2 n}{n^2}$

5.一圓與一正方形之總周長爲 16，若欲產生最小之總面積，則圓與正方形的尺寸應各爲多少? (10 分)

6.已知 $A=x^2yz\mathbf{i}-x^3y^3\mathbf{j}+xyz^3\mathbf{k}$，求 $div(curl\ A)=\nabla\cdot(\nabla\times A)$ (10 分)

7.作圖 $f(x)=4x^{1/3}+x^{4/3}$，標出極值和反曲點 (10 分)

8.令 $w=\sqrt{x}+y^2z^3$，$x=1+u^2+v^2$，$y=uv$，$z=3u$，求 $\frac{\partial w}{\partial u}$ 及 $\frac{\partial w}{\partial v}$ (10 分)

國立中山大學九十一學年度碩士班招生考試試題

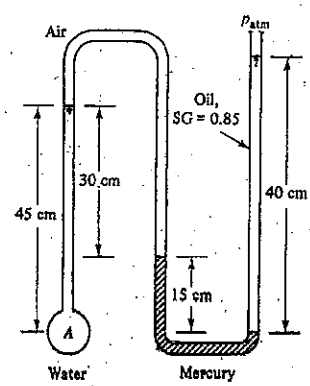
科目：流體力學 (海資所)(兩組適考)

一、解釋名詞(50 分)

1.Navier-Stokes equation
2.turbulent and laminar flow
3.shear stress and viscosity
4.dimensional analysis
5.hydraulic jump
6.lift and drag of airfoil
7.Venturi meter
8.Mach number
9.Bernoulli equation
10.viscous sublayer

二、一艘船的長度爲 35 m，船速爲 11 m/s，它以一艘長度爲 1 m 的模型船來作試驗，請問模型船的速度需爲多少? 模型船對實船的阻力比例是多少? (10 分)

三、Determine the gauge pressure at point A in pascals. Is it higher or lower than atmospheric? (specific weight of water = 9790 N/m^3, air = 11.8 N/m^3, mercury = 133,100 N/m^3) (10 分)



四、A flow field is described by the streamline equation (15 分)

$\psi = xy$

(a) Determine the velocity field
(b) Determine the velocity potential function
(c) Determine whether the flow satisfies the continuity equation
(d) Determine whether the flow is rotational

五、有一水管的流量爲 1.42 m^3/s，水管的截面積不等，包含一個泵浦，泵浦輸送 300 kW 的功率。水管在兩個斷面(1 和 2)的測量結果爲: $A_1 = 0.4$ m^2，$A_2 = 0.2$ m^2，$Z_1 = 9$ m，$Z_2 = 24$ m，$p_1 = 138$ KPa，$p_2 = 69$ KPa，計算 1 和 2 斷面的水頭損失。(水的比重爲 9810 N/m^3，P(功率)=QρgE，Q: 流量，E: 水頭) (15 分)

國立中山大學九十一學年度碩士班招生考試試題

科目：礦物學（海資所）（兩組選考）

一、 解釋名詞（每小題 3 分，共 30 分）

1. electronegativity
2. solid solution
3. crystal form
4. streak
5. mineral
6. unit cell
7. twinning
8. amorphous
9. electron microprobe
10. Haüy's Law (Law of Rational Indices)

二、 問答題（每小題 10 分，共 70 分）

1. (a) 礦物分類的依據是甚麼？(b) 通常可分為那幾大類？(c) 其中那一大類礦物在地殼最為常見？
2. 在沒有儀器分析的協助下如何利用礦物的物理性質來鑑定礦物？試以野外常見的四種造岩礦物: 石英、長石、方解石、和白雲母作例子，說明如何鑑定它們。
3. 何謂點群（point group）？何謂空間群（space group）？兩者的基本不同點在那裡？
4. 試繪圖說明氯化鈉(NaCl)結構和氯化銫(CsCl)結構，並說明其布拉維晶格型式。
5. 試利用簡繪之赤平投影圖（stereoprojection）及假設之晶面極（face pole，取 general form 之晶面）作以下點群之對稱運作，找出並投繪出其他晶面極，並指出該點群所屬晶系和所產生之晶形名稱（crystal system and crystal form）

   (a) 旋逆對稱 $\bar{3}$，(b) 2/m 2/m 2/m
6. 試說明下列 Hermann-Maugin 符號之意義（符號代表什麼意義？代表什麼性質？各個數字在空間中相對於晶體座標系統的關係為何？可繪圖輔助說明）

   （a）$F4_132$，（b）$C2/m$
7. 有一長石（feldspar）晶體，經由化學分析知其化學成份為 SiO_2= 65.90 %，Al_2O_3 = 19.45 %，Fe_2O_3 = 1.03 %，CaO = 0.61 %，Na_2O = 7.12 %，K_2O = 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 O = 16.0，Si = 28.1，Al = 27.0，Fe = 55.8，Ca = 40.1，Na = 23.0，K = 39.1）。

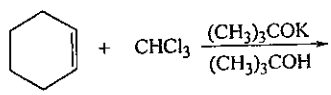
國立中山大學九十一學年度碩士班招生考試試題

科目：有機化學 (海洋資源學系)(丁組)

1. Give the structure of each of the following compounds. (12%)
   (1) 7-hydroxy-7-methyl-4-octen-2-one
   (2) 4-hydroxy-3-ethoxybenzoic acid
   (3) *N*-methylacetamide
   (4) (ethoxymethyl)benzene

2. Write the product of each of the following reactions. (30%)

(1)



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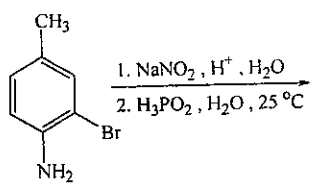

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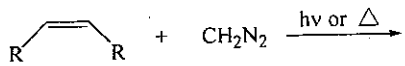

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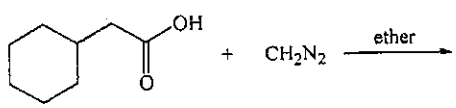

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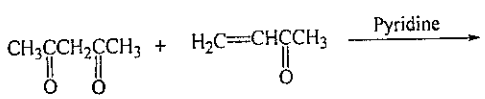
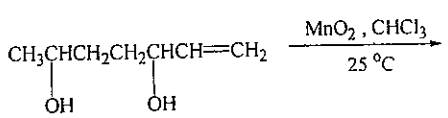


(6)



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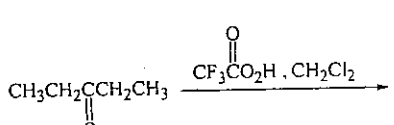

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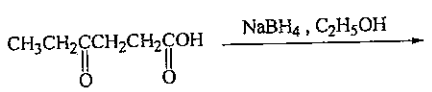

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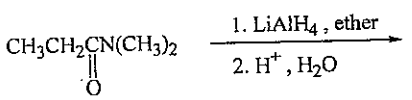

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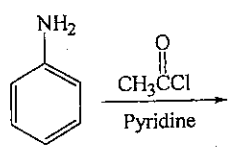
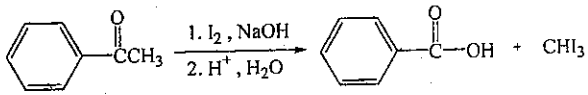


3. Write a step-by-step mechanism of each of the following reactions. (30%)

(1)



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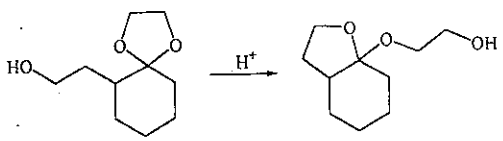

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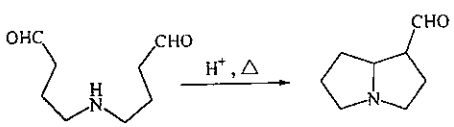

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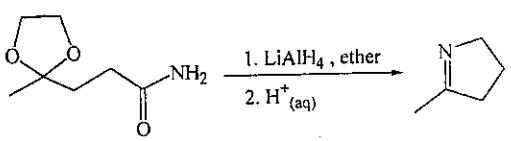

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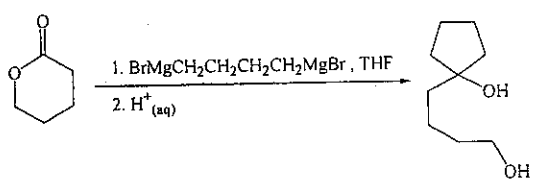
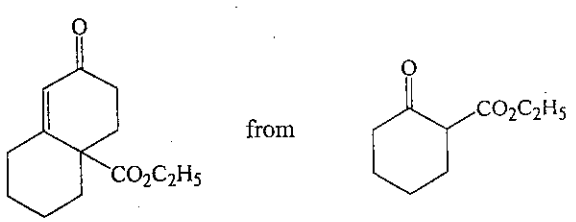


4. Show how you would synthesize the following compounds from the indicated starting materials. You may use any additional reagent you need. (18%)

(1)



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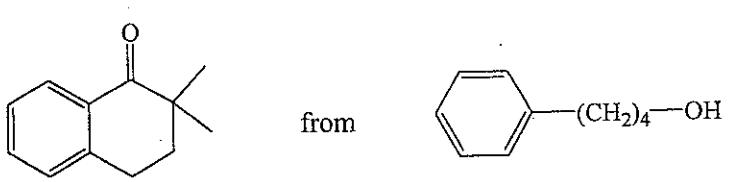

5. Deduce the structure which would be consistent with the spectral data and molecular formula given. (10%)

$C_{10}H_{10}O_2$

IR : 1720, 1630, 1578, 1490, 980, 765, 684 cm^{-1}

^1H NMR : δ 3.82 (3H, s), 6.44 (1H, d, J = 16.2 Hz), 7.34－7.57 (5H, m), 7.71 (1H, d, J = 16.2 Hz).

國立中山大學九十一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)

請注意：考題中若涉及計算，請將演算過程列出，否則該題不予計分。

(12%)1.Explain the difference between
(a)accuracy and precision.
(b)mean and median.
(c)variance and standard deviation.

(9%)2.How would you prepare
(a) 20.0% (w/v) aqueous ethanol ?
(b) 20.0% (v/v) aqueous ethanol ?
(c) 20.0% (w/w) aqueous ethanol ?

(8%)3.What is the pH of the buffer formed by adding 50.0 mL of 1.00 M NaH_2PO_4 with
(a)50.0mL of 0.50 M HCl ?
(b)50.0mL of 0.50 M NaOH ?
(For H_3PO_4, pKa_1=2.3, pKa_2=7.2, pKa_3=12.3)

(8%)4.Distinguish the following terms for titrimetric methods of analysis.
(a)the equivalence point and the end point of a titration
(b)a primary standard and a secondary standard

(6%)5.Calculate the percentage of MnO_2 in a mineral specimen if the I_2 liberated by a 0.1334 g sample in the net reaction

$$MnO_{2\,(s)} + 4H^+ + 2I^- \rightarrow Mn^{2+} + I_2 + 2H_2O$$

required 32.30 mL of 0.07220M $Na_2S_2O_3$.
(atomic weight of Mn=54.9)

(6%)6.An aqueous solution contains $NaNO_3$ and KSCN. The thiocyanate ion is precipitated as AgSCN by addition of $AgNO_3$. After an excess of the precipitating reagent has been added,
(a)what is the charge on the surface of the coagulated colloidal particles ?
(b)what is the source of the charge ?
(c)what ions predominate in the counter-ion layer ?

(9%)7.Describe or define the following terms in electrochemistry.
(a)potentiometric methods
(b)electrogravimetric methods
(c)coulometric methods

(6%)8.Describe alkaline error in the measurement of pH. Under what circumstances is this error appreciable ? How are pH data affected by alkaline error ?

(5%)9.From the standard potentials

$Tl^{+} + e^{-} \rightarrow Tl_{(s)}$ $E^{0} = -0.336V$

$TlCl_{(s)} + e^{-} \rightarrow Tl_{(s)} + Cl^{-}$ $E^{0} = -0.557V$

Calculate the solubility product constant for TlCl.

(5%)10.A compound had a molar absorptivity of 2.00×10^{3} L • cm^{-1} • mol^{-1}. What concentration of the compound would be required to produce a solution having a transmittance of 10.0% in a 2.50 cm cell ?

(6%)11.Show the basic structure and describe the principle of spectrofluorometer.

(9%)12.Define the following terms for atomic absorption spectroscopy.

(a)atomization

(b)hollow-cathode lamp

(c)sputtering

(6%)13.Describe the fundamental difference between adsorption and partition chromatography.

(5%)14.Describe the basic principle of size-exclusion chromatography.