1. What are the categories of animal tissue?　What are the functions of these tissues?　How are the structure of these tissues suited for these functions?　20%
2. What four factors influence the structure of a community and how? 10%
3. How would you define the trophic structure of an ecosystem? What are the five trophic levels possible in an ecosystem? What criteria can be used to distinguish among these five trophic levels?　　10%
4. How are RNA viruses classified? What type of virus is HIV?　10%

5. 詳述細胞的大小如何決定? 25%

6. 詳述細胞間如何傳遞訊息? 25%

1. 詳述人體血壓的調控機制？（30分）
2. 細胞的膜電位（resting membrane potential）如何產生？（20分）
3. 何謂生理節律（biological rhythm）？（10分）詳述其控制機制（20分）
4. 何謂 neurotransmitter？（10分）何謂 neuromodulator？（10分）

1. (5%) What are the differences between terms of motif and domain in protein structures?

2. (20%) Please draw the structure of glucose and fructose, and use the concepts of structure to explain their biochemical properties.

3. (10%) Please list the environmental factors that change the enzyme activities, and explain your reasons on each listed.

4. (20%) Write the sequence of the mRNA molecule synthesized from a DNA template strand having the sequence 5'-ATCGTACGGTTA.

5. (10%) A transfer RNA with a UGU anticodon is enzymatically charged with a ^{14}C-cysteine. The cysteine unit is then chemically modified to aniline, using Raney nickel which removes the sulfur atom of cysteine. The altered aminoacyl-tRNA is added to a protein-synthesizing system containing normal components except for this tRNA. The mRNA added to this mixture contains the following sequence:
5'-UUUUGCCAUGUUUGUGGCU.

6. (35%) Please translate the following message into Chinese. What is the best title for this message?

The absence of galactose-1-phosphate uridyl transferase causes galactosemia, a severe disease that is inherited as an autosomal recessive trait. The metabolism of galactose in persons who have this disease is blocked at galactose 1-phosphate. Afflicted infants fail to thrive. Vomiting or diarrhea occurs when milk is consumed, and enlargement of the liver and jaundice are common. Furthermore, many galactosemics become mentally retarded. The blood galactose level is markedly elevated, and galactose is found in the urine. The absence of the transferase in red blood cells is a definitive diagnostic criterion.

一. 解釋名詞(40%) (每題 5 分)

1. Ecology	2. Character displacement
3. Euphotic zone	4. Entropy
5. Vant Hoff's law	6. Red tide
7. Eutrophication	8. El Niño

二. 問答題 (60%)

1. 請敘述台灣四周有哪些海域、海峽及海流？各水文特徵為何？有何季節變化？
   （15 分）

2. 請問台灣現存的紅樹林有哪些種類（寫出其中三種即可）？它們分布的地區或範圍大概在哪裡？各有何重要生理生態特徵？紅樹林有何重要性？（15 分）

3. 請列點說明影響生物群聚構造（或消長）的因素有哪些？ (10 分)

4. 請繪圖並舉例說明族群生存曲線(Survivorship curves)型式有哪些？（10 分）

5. 要建立一個好的生態模式必須具備哪些要件？(10 分)

(20%)1. 某養殖場所養的某種魚，在往年收穫時平均重量為 380 克，今年由族群中逢機取 49 隻魚，餵以新的飼料，收穫時之體重資料為：n=49，$\bar{y}$=390 克，S=35 克，請測試新飼料所養出之魚平均重量是否大於 380 克？（α=0.01）

註：$s = \sqrt{\dfrac{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}{n-1}}$

(15%)2. 家庭廢水的排放會影響水體中，生物賴以生存之溶氧量，生態學家每個星期在河口同一位置採樣，持續 2 個月，共獲 9 個樣品，請利用以下電腦印出之基本資料（Sample Statistics），來估計水體中平均溶氧的 95%可信界限（Confidence interval）。

Sample Statistics

Sample size = 9

$\bar{y}$= 4.95 ppm ； S^2= 0.2025 ppm^2 ； S= 0.450 ppm

(25%)3. 高雄附近海域有三條海洋放流管，其中兩條（分別在左營、大林蒲）放流工業廢水，而另一條（中洲）放流家庭廢水，如果你（妳）想知道這三條放流管對底棲魚類是否有影響，請設計一個單因子變異數分析（One-way Analysis of variance）實驗，並詳述採樣項目，採樣方法，及數據分析之統計方法（15%）；並以你的實驗設計配合完成下列變方分析表中，A~E 之空格，其中自由度（df）請按設計內容於 C~E 格寫出阿拉伯數目。(10%)

註：實驗設計的說明中，請明確寫出各變項數目，以與 C-E 格中數目對應

Source of Variation	SS	df	F	P
A		C		
B		D		
Total		E		

(20%)4. 為配製某種染料，需使用鹽酸，以下數據為 6 批（batch）鹽酸，每批做 5 個測定，所得數值（克）：

batch	Sample mean
1	505
2	528
3	564
4	498
5	600
6	470

數據分析如下表，請完成其中 F~L 之空格（14%），並下結論（α=0.05）（6%）。

Source of Variation	SS	df	MS	F
Between batches	F	G	J	L
Within batches	58824	H	K	
Total		I		

(20%)5. 由以下表格，(1)請寫出所獲得的訊息。(10%)

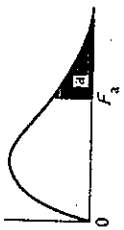　　　　　　(2)若繼續分析，可進行哪些分析？並請說明為何要進行這些分析。(10%)

Linear regression equations depicting the relationships in the spring (Cruises 606 and 638) in the South China Sea of the euphotic-layer averaged primary production (IPP/Deu, g C m^{-3}d^{-1}) and nitrate-based new production (INP/Deu, g C m^{-3}d^{-1}) with 3 independent variables including the surface chlorophyll a concentration (Chl, mg m^{-3}) ,surface water temperature (Temp, ℃) and nitracline depth (Nitracline, m), which are mutually covariated , n=11

Production	Linear regression equation	R^2	Significance
IPP/Deu	0.00035+0.024 Chl	0.70	**
	0.051-0.002 Temp	0.49	*
	0.011-0.000158 Nitracline	0.53	*
INP/Deu	-0.00033+0.008 Chl	0.84	**
	0.015-0.001 Temp	0.45	*
	0.003-0.000050 Nitracline	0.51	*

$*p < 0.05; **p < 0.01$

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

Percentage points of the F distribution ($a = .05$)

df_2 / df_1	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	∞
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00

(1) (10%) Find the first three nonzero terms of the Taylor series expanded about $x = 0$ for $f(x) = x^2 e^{-x^2}$.

(2) (15%) Evaluate $\int \frac{1}{4x^2 + 4x + 5}\, dx$.

(3) (15%) Find all relative extreme values of $f(x) = x + \frac{1}{x}$.

(4) (15%) Find the limit $\lim_{x \to \infty}(1 + \frac{1}{x})^x$.

(5) (15%) Determine whether the improper integral $\int_0^\infty \frac{1}{e^x + e^{-x}}\, dx$ exist and, if so, find the value.
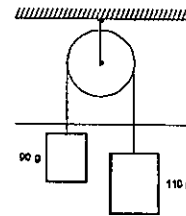
(6) (15%) Find all relative extreme values of
$f(x, y) = 4x - 2y - x^2 - 2y^2 + 2xy - 10$.

(7) (15%) Evaluate the double integral

$$\int\int_R xy\, dA$$

where $R = \{(x, y) | x^2 + y^2 \leq 4, y \geq 0\}$.

1. Two blocks are connected by a string and pulley as shown in the right. Assuming that the string and pulley are massless, what is the magnitude of the acceleration of each block? (10%)

2. An automobile moves on a level horizontal road in a circle of radius 30 m. The coefficient of friction between tires and road is 0.50. What is the maximum speed this car can round this curve? (10%)

3. A 0.50-kg block attached to an ideal spring with a spring constant of 80 N/m oscillates on a horizontal frictionless surface. When the spring is 4.0 cm shorter than its equilibrium length, the speed of the block is 0.50 m/s. What is the greatest speed of the block? (10%)

4. A playground merry-go-round (旋轉木馬) has a radius of 3.0 m and a rotational inertia of 600 kg x m². It is initially spinning at 0.80 rad/s when a 20-kg child crawls from the center to the rim. When the child reaches the rim, find the angular velocity of the merry-go-round. (10%)

5. A 5.0 m weightless strut, hinged to a wall, is used to support an 800-N block as shown in the right. What is the tension in the horizontal rope? (10%)
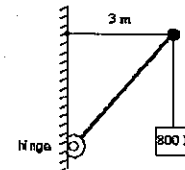
6. A wave is described by $y(x,t) = 0.1 \sin(3x + 10t)$, where x is in meters, y is in centimeters and t is in seconds. Find out the wavelength and frequency. (10%)

7. Each of the four capacitors shown is 500 μF. The voltmeter reads 1000V. What is the magnitude of the charge, in Coulombs, on each capacitor plate? (10%)
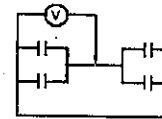
8. In an RC series circuit, emf $\mathcal{E}$=12.0 V, R=1.4 MΩ, and C=1.80 μF.
   (a) Calculate the time constant. (b) Find the maximum charge that will appear on the capacitor during charging. (10%)

9. What is the entropy change for 3.2 mol of an ideal monatomic gas undergoing a reversible increase in temperature from 380 K to 425 K at constant volume? (10%)

10. A plumber has constructed the pipe system shown in the right, where the radii of the pipe sections are given in terms of R_B=2.0 cm. The pipe sections have vertical *standpipes*, which are tubes that are too tall for water to be pushed out of them by the pressure in the pipe system. The tubes are open at the top to an air pressure of 1.0 atm. If the water extends up into the standpipe for section D by 0.50 m, and the volume flow rate through the pipe sections is 2.0 x 10^{-3} m³ /s, then how high does the water extend up into the standpipe for section B?(10%)
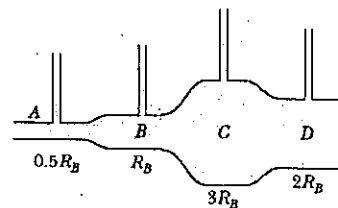
一、 解釋名詞（每小題 2.5 分，共 20 分）

1. ionic bonding
2. pillow basalt
3. pyroclastic flow
4. spheroidal weathering
5. transform fault
6. unconformity
7. metasomatism
8. ophiolite

二、 問答題（每小題 10 分，共 80 分）

1. 礦床（mineral deposit）從成因上分可以區分為那幾種類型？並簡單說明各類礦床之形成機制或過程。

2. 試分別敘述安山岩質火山和玄武岩質火山出現地點之板塊地體構造環境。

3. 岩漿的黏滯性（viscosity）取決於哪些因素？和火山災害有什麼關連？

4. 試敘述在中洋脊（mid-ocean ridge）擴張中心（spreading center）處所發生的各種地質作用，並討論這些作用對海水中所含元素的影響以及其和深海礦床間的關係。

5. 花岡岩風化後會變成什麼？試以簡單之礦物反應式討論之。這些腐爛的石頭所產生的產物有什麼經濟用途？

6. (a) 變質作用可以分為那些類型？各有甚麼特點，試說明之。
   (b) 台灣的中央山脈變質岩區屬於哪一種變質作用類型？
   (c) 台灣的金瓜石銅礦區屬於哪一種變質作用類型？

7. 變質岩常見的一個重要特徵是具有葉理（foliation），(a) 試說明變質岩的葉理是如何形成的。(b) 哪些變質岩具有葉理？

8. 常見的造岩礦物有石英、方解石、鈣斜長石、鈉斜長石、鉀長石、輝石、橄欖石、角閃石、雲母、以及黏土礦物等，如果這些礦物暴露在地表，你認為他們之中哪些是比較容易遭受風化，哪些比較抗風化？請依序排列，並討論其原因。

問答題（每題 10 分，共 100 分）

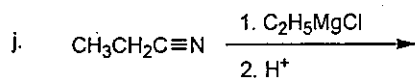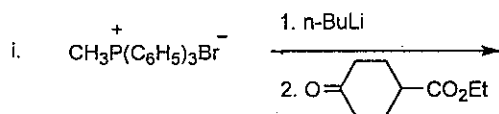1. (a) 礦物的定義是甚麼？(b) 為什麼同一種礦物（例如石英）的所有樣品都具有相似的物理性質？

2. 研究礦物學有什麼重要性？

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. 何謂 octahedral site（or octahedral vacancy）與 tetrahedral site？試以白雲母為例說明之，白雲母化學式為 $KAl_2(Si_3AlO_{10})(OH)_2$。

5. 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。

6. 我們在日常生活中用到非常多的金屬資源，例如鐵、鋁、和銅等。請問鐵、鋁、和銅主要分別來自什麼礦物。這些礦物資源產出於什麼樣的地質條件或環境。試說明之。

7. 有一橄欖石（olivine）晶體，經由化學分析知其化學成份為 $SiO_2 = 41.07\%$，$TiO_2 = 0.05$，$Al_2O_3 = 0.56\%$，$Fe_2O_3 = 0.65\%$，$FeO = 3.78\%$，$MnO = 0.23\%$，$MgO = 54.06\%$（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 $O = 16.0$，$Si = 28.1$，$Ti = 47.9$，$Al = 27.0$，$Fe = 55.8$，$Mn = 54.9$，$Mg = 24.3$）。

8. 一個晶體可以有一個 2-重旋轉軸（2-fold axis of symmetry），也可以有好幾個 2-重旋轉軸，但是沒有一個晶體會剛好有兩個 2-重旋轉軸，為什麼晶體不會有兩個 2-重旋轉軸？一個晶體最多可以有幾個 2-重旋轉軸？（可以利用簡繪之赤平投影圖繪圖輔助說明）

9. 等軸晶系和正方晶系中各有哪幾種形式之布拉維晶格（Bravais lattices）？那一種布拉維晶格是等軸晶系中有而正方晶系中沒有？為什麼？（請繪圖討論並說明其理由）

10. 何謂配位數（coordination number）？假設離子鍵晶體其化學式為 AX（A：陽離子，X：陰離子），當其 R_A/R_X（陽陰離子半徑比值）分別是落在 0.22~0.41，0.41~0.73，和 > 0.73 等範圍時，請討論其對應之配位數值，以及離子堆疊方式（即結晶構造，可用結晶構造實例作說明）。

1. Write a structure for each of the following compounds. (2% each)

   a. (1R, 2R)-2-Bromocyclohexanol
    b. m-Chloroperoxybenzoic acid
    c. 4-Methoxypyridine
    d. Indole-3-carboxylic acid

    e. 3,5-Cyclohexadiene-1,2-dione
    f. 2-(2-Propenyl)cyclohexanone
    g. 5-Bromo-3-ethynylcycloheptanone
    h. Ethyloxacyclopropane

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

a.

MeLi

b. $(CH_3)_2CHCH_2CHCH_3$ (with OH on the CHCH_3 carbon) $\xrightarrow[-H_2O]{H_2SO_4, \ \Delta}$

c.

$\xrightarrow{CH_3COOH}$

d.

$\xrightarrow{MCPBA}$

e.
 + $HOCCH_2CH_2OH$ (with CH_3 groups) $\longrightarrow$

f.

$\xrightarrow[conc. \ H_2SO_4]{SO_3}$

g. $CH_3CCH_2CH_2CH_2COOCH_3$ (with =O) $\xrightarrow{NaBH_4}$

h.
 + $\xrightarrow{\Delta}$

i. $CH_3\overset{+}{P}(C_6H_5)_3\overset{-}{Br}$ $\xrightarrow[\text{2. } O=\text{cyclohexane}-CO_2Et]{\text{1. n-BuLi}}$

j. $CH_3CH_2C\equiv N$ $\xrightarrow[\text{2. } H^+]{\text{1. } C_2H_5MgCl}$
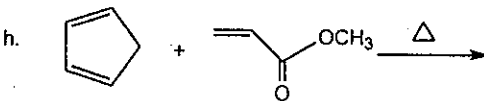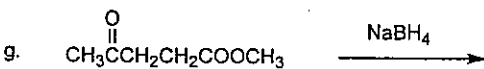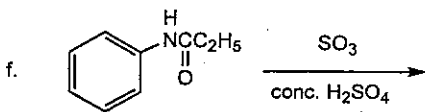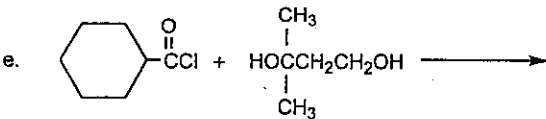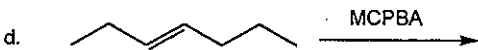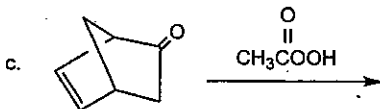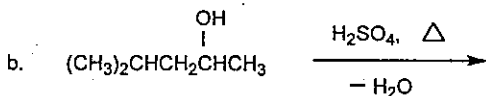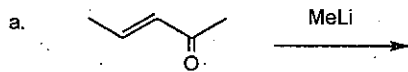
3. Give a detailed mechanism for each of the following reactions. (8% each)

a.

b.

c.

d.
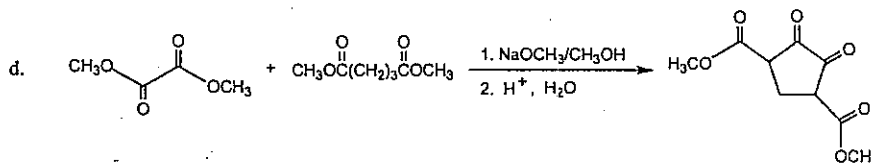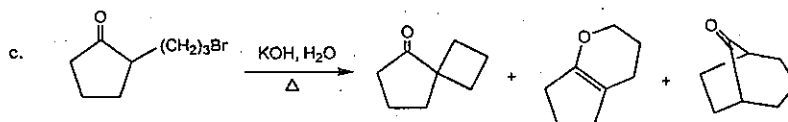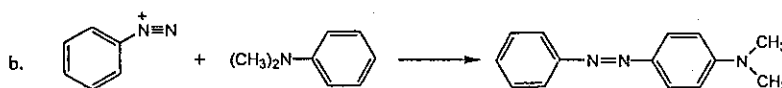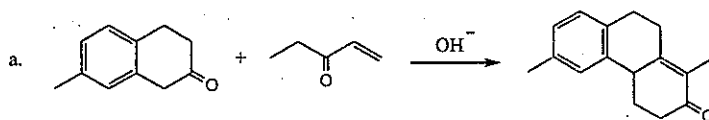
4. Deduce the structure for each of the following compounds with the provided molecular formulas and NMR spectral data.

a. $C_5H_9BrO_2$：δ 1.3(t, 3H), 1.8(d, 3H), 4.3(quintet, 3H).
   The latter peaks arise from two nearly overlapped quartets. (7%)

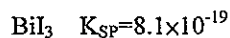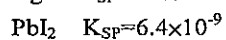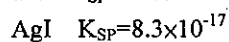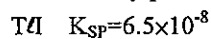b. $C_6H_{13}NO_2$(an ester)：δ 1.3(t, 3H), 2.4(s, 6H), 3.2(s, 2H), 4.2(q, 2H). (7%)

c. $C_{15}H_{20}O_4$：δ 0.8(t, 3H), 1.2(t, 6H), 2.3(q, 2H), 4.2(q, 4H), 7.3(s, 5H). (8%)

請注意：（a）若涉及計算，請將演算過程列出，否則不予計分
（b）log2=0.30, log3=0.48

（15%）1. Define the following terms：
　　　　(a) weak acid
　　　　(b) zwitterion
　　　　(c) amphiprotic solute
　　　　(d) precision
　　　　(e) accuracy

（10%）2. The solubility products for a series of iodides are
　　　　TtI　　$K_{SP}=6.5 \times 10^{-8}$
　　　　AgI　　$K_{SP}=8.3 \times 10^{-17}$
　　　　PbI_2　　$K_{SP}=6.4 \times 10^{-9}$
　　　　BiI_3　　$K_{SP}=8.1 \times 10^{-19}$
　　　　List these four compounds in order of decreasing molar solubility in
　　　　(a) 0.10M NaI solution.
　　　　(b) a 0.010M solution of the solute cation.

（6%）3. What will be the pH of a 1.00M CH_3COOH solution?
　　　　（For CH_3COOH, pKa=5）

（10%）4. Neglecting any effects cause by volume changes, would you expect the
　　　　ionic strength to (1) increase (2) decrease, or (3) remain unchanged by
　　　　addition of HCl solution to a dilute solution of
　　　　(a) NaOH.
　　　　(b) acetic acid.
　　　　Explain your answer in detail.

（6%）5. How many milliliters of 0.0500M EDTA are required to react with 50.0
　　　　mL of 0.0100M Ca^{2+}?　With 50.0mL of 0.0100M Al^{3+}?

（6%）6. What causes a liquid junction potential?　How does this potential limit
　　　　the accuracy of potentiometric analyses?

（10%）7. List the sources of error associated with pH measurement using glass
　　　　electrode.

（6%）8. Explain what concentration polarization is. How does it affect the magnitude of voltage available from a galvanic cell and the magnitude of voltage required for electrolysis ?

（10%）9. Distinguish between fluorescence and phosphorescence. Why is phosphorescence rarer than fluorescence ?

（6%）10. Which molecular process correspond to the energies of microwave, infrared, visible and ultraviolet photons ?

(15%) 11. Describe the mechanism of interaction of the solute with the stationary phase for the following types of chromatography :
    (a) adsorption chromatography
    (b) partition chromatography
    (c) ion-exchange chromatography
    (d) size-exclusion chromatography
    (e) affinity chromatography