# 國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：分子生物學【海資系碩士班甲組選考】　　題號：452001

※本科目依簡章規定「不可以」使用計算機　　

1. Describe the translation process in prokaryotes. (20%)

2. Explain the functions of DNA polymerases in eukaryotes. (15%)

3. What is the mechanism of eukaryotic RNA splicing? (15%)

4. Draw *trp* operon and explain the regulatory regimens in tryptophan synthesis. (20%)

5. Use Chinese to translate the following passage and explain its significance. (30%)

We have solved the x-ray structures of the binary horseradish peroxidase C-ferulic acid complex and the ternary horseradish peroxidase C-cyanide-ferulic acid complex to 2.0 and 1.45 Å, respectively. Ferulic acid is a naturally occurring phenolic compound found in the plant cell wall and is an *in vivo* substrate for plant peroxidases. The x-ray structures demonstrate the flexibility and dynamic character of the aromatic donor binding site in horseradish peroxidase and emphasize the role of the distal arginine (Arg38) in both substrate oxidation and ligand binding. Arg38 hydrogen bonds to bound cyanide, thereby contributing to the stabilization of the horseradish peroxidase-cyanide complex and suggesting that the distal arginine will be able to contribute with a similar interaction during stabilization of a bound peroxy transition state and subsequent O-O bond cleavage. The catalytic arginine is additionally engaged in an extensive hydrogen bonding network, which also includes the catalytic distal histidine, a water molecule and Pro139, a proline residue conserved within the plant peroxidase superfamily. Based on the observed hydrogen bonding network and previous spectroscopic and kinetic work, a general mechanism of peroxidase substrate oxidation is proposed.

# 國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：有機化學【海資系碩士班丁組】　　題號：452002

※本科目依簡章規定「不可以」使用計算機　　

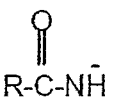
1. Explain the following terms (3% each)
   a. Aldol condensation
   b. Claisen condensation
   c. Grignard reagent
   d. Wittig reaction
   e. Chiral center
   f. Enamtiomers
   g. Diasteriomers
   h. Chiral resolving agent
   i. Magnetic equivalence
   j. Magnetic anistropy

2. Draw structures for the following compounds. (3% each)
   a. 4-Ethyl-2,3-dimethyloctane
   b. 3-Methyl-3-ethyl-1-pentyne
   c. (*E*)-3-methyl-2-pentene
   d. 2-Butyl-4-methylpentanoate
   e. 3-Carbethoxycyclobutene
   f. 3-Amino-1-cyclopentene

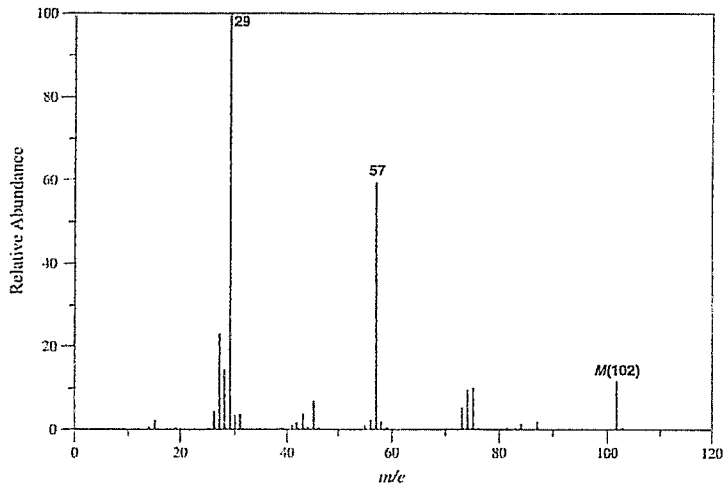
3. Write structures for compounds that belong in the following classes (3% each)
   a. Semicarbazole
   b. Cyclic unsaturated anhydride
   c. Oxime of an aromatic lactone
   d. γ-Diketone
   e. β,γ-Unsaturated-δ-lactone

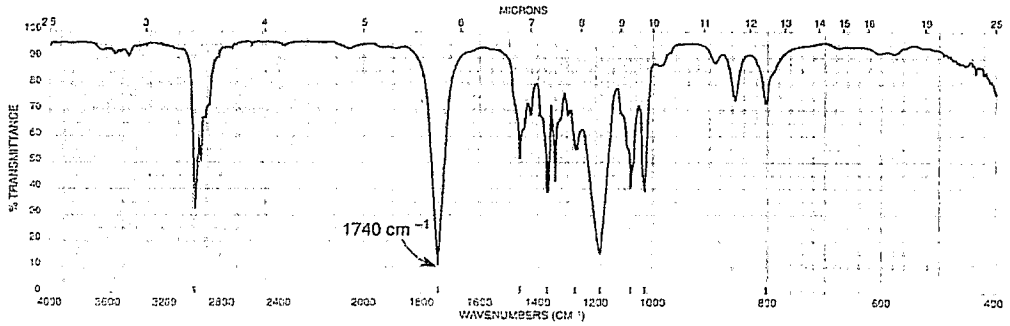
4. Compare the stability of each of the following pairs of organic ions (3% each)

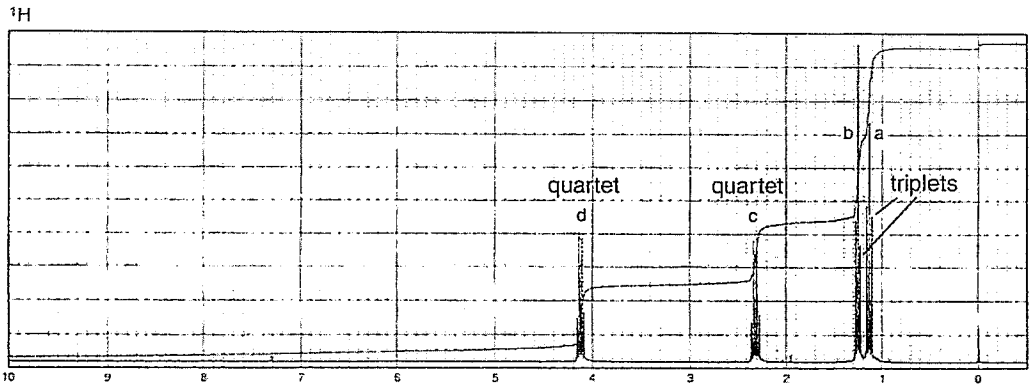
   a) $C_6H_5CH{=}CHCH_2^+$　　$CH_3CH{=}CH{-}CH_2^+$

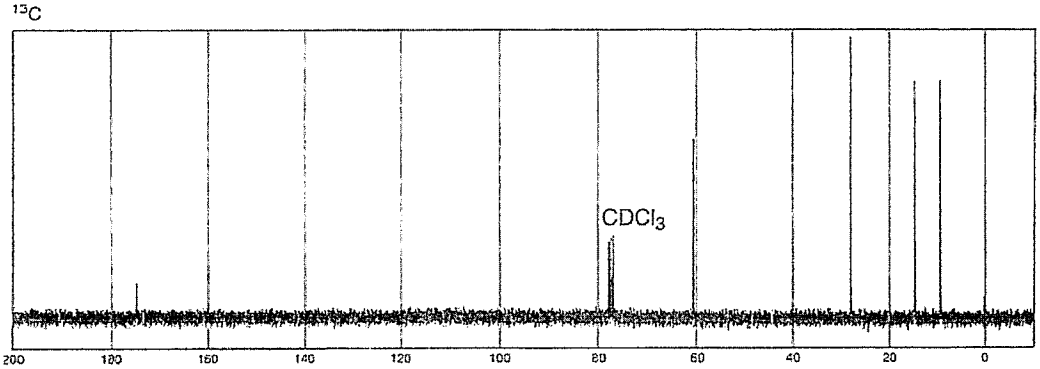
   b)  　　 

5. The UV spectrum of a compound shows only end absorption. Determine the structure of the compound from the following spectra. (10%)

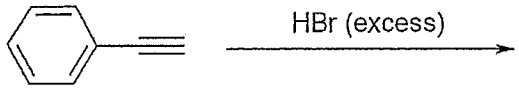


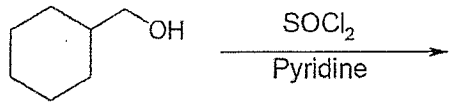



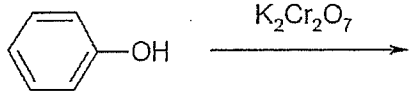



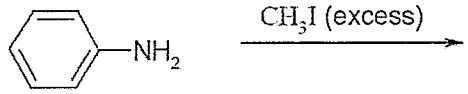
6. Give the expected major product for the following reactions. (3% each)

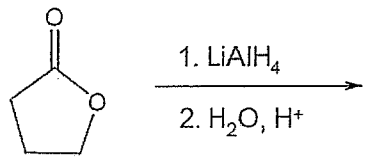
a) 

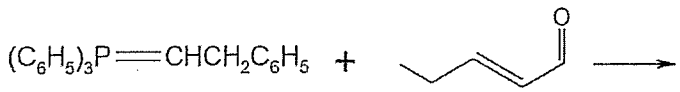

b) 


c) 


d) 


e) 


f) 


g) 

# 國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：普通生物學【海資系碩士班甲組選考、乙組】　　題號：452004

※本科目依簡章規定「不可以」使用計算機　　

一、詳述生物體細胞大小的決定因子。(10分)
　　又，詳述生物為何由單細胞演化成多細胞個體。(10分)

二、太陽的光能如何轉換成動物所需之ATP，請詳述步驟。(30分)

三、詳述動物循環系統的演化。(30分)

四、請概分幾個發展階段，說明生物學的發展史，並舉例各階段之重要一種生物科學技術。(20分)

# 國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：生理學【海資系碩士班甲組選考】　　題號：452005

※本科目依簡章規定「不可以」使用計算機　　

一、何謂恆定(Homeostasis)?(5分)人體如何調控pH值的恆定?(20分)

二、詳述人體血壓的調控機制。(30分)

三、詳述人體呼吸速率的調控機制。(30分)

四、詳述細胞靜止膜電位(resting membrane potential)。(5分)
及動作電位(action potential)的形成機制。(10分)

# 國立中山大學 102 學年度碩士暨碩士專班招生考試試題

科目名稱：分析化學【海資系碩士班丁組】　　題號：452006

※本科目依簡章規定「不可以」使用計算機　　

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
(c)原子量:C=12.0=16.Na=23.K=39.Cr=52

1. How many significant figures does each of the following numbers have ?
   (a)200.06
   (b)$6.030 \times 10^{-4}$
   (c)$7.80 \times 10^{10}$
   (d)7000.0
   (e)0.00200. (10%，2% each)

2. Calculate the normality of the solutions containing the following:
   (a)5.300g/L $Na_2CO_3$ (when $CO_3^{2-}$ reacts with two protons), (5%)
   (b)5.267g/L $K_2Cr_2O_7$ (the Cr is reduced to $Cr^{3+}$). (5%)

3. A buffer solution is 0.10 M in acetic acid and in sodium acetate. Calculate the change in pH upon adding 5.0mL of 0.10 M hydrochloric acid to 10mL of this solution. (pKa of acetic acid is 4.75) (10%)

4. What is an amphiprotic solvent? (3%) An aprotic solvent? (3%)

5. What does "TD" on glassware mean? (3%) "TC" ?(3%)

6. There are two kinds of electrochemical cell, galvanic and electrolytic .
   (a)What's the difference between these two electrochemical cells ? (5%)
   (b)What is the function of a salt bridge used in an electrochemical cell ? (5%)

7. Identify factors that cause the Beer's law relationship to depart from linearity. (10%)

8. Explain the mechanism of operation of a hollow-cathod lamp in atomic absorption spectrophotometer. (10%)

9. Ninety-six percent of a solute is removed from 100mL of an aqueous solution by extraction with two 50mL portions of an organic solvent .What is the distribution coefficient of the solute? (10%)

10. Describe the principle of the following gas chromatographic detectors:
    (a) thermal conductivity; (6%)
    (b) electron capture; (6%)
    (c) flame ionization . (6%)

# 國立中山大學102學年度碩士暨碩士專班招生考試試題

科目名稱：生物化學【海資系碩士班甲組選考】　　題號：452007

※本科目依簡章規定「不可以」使用計算機　　

1. Arthropods such as lobsters have oxygen carriers quite different from hemoglobin. Describe their oxygen-binding sites in comparing with the heme types. (15%)

2. Give an example of enzyme reaction and show the Michaelis-Menten Equation to describe its kinetics. (10%)

3. What are the biochemical differences between starch and cellulose? (10%)

4. What is the energy generation during glycolytic pathway? (15%)

5. Explain the key terms: (20%, 2 points each)
   (a) Dark reaction
   (b) Autotroph
   (c) Oxidative phosphorylation
   (d) Cytochrome c
   (e) TCA cycle
   (f) Acetyl CoA
   (g) Gluconeogenesis
   (h) Rossmann fold
   (i) Pyruvate kinase
   (j) Receptor signal-transduction

6. Translate the following passage into Chinese. (30%)

The peroxidase activity in a single protoplast of alga *Bryopsis plumosa* is quantitatively characterized by scanning electrochemical microscopy. The generation of ferriceniummethanol (FMAt) at the protoplast surface is directly detected by the microelectrode tip scanned close to the sample surface in seawater containing ferrocenemethanol (FMA) and hydrogen peroxide, an electron mediator and an enzyme-substrate, respectively. The oxidation reaction requires hydrogen peroxide, which clearly shows FMAt generation due to the peroxidase (POD) catalytic reaction occurring in the protoplast. The FMAt generation and the FMA accumulation rates at a single alga protoplast were equivalent. A plot of the FMAt generation rates according to the hydrogen peroxide concentrations was well allowed with a Michaelis–Menten-type reaction. An estimation of the mass-transfer rate and a determination of the Km are quite important advantages of the Scanning electrochemical microscopy (SECM) technique that cannot be realized using other techniques. The POD activity has been further investigated from the viewpoint of the size of the protoplast. The POD activity of the alga in the adult stage is also visualized by SECM. The noninvasive nature of the SECM technique has been confirmed by observing the developmental process after measurements.