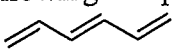
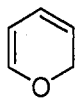
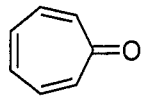
國立中山大學107學年度碩士暨碩士專班招生考試試題

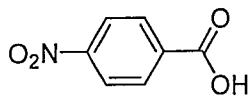
科目名稱：有機化學【海資系碩士班丙組】　　題號：452001

※本科目依簡章規定「不可以」使用計算機(混合題)

一、單選選擇題(45%, 3% for each)

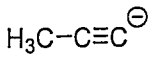
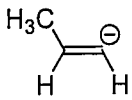
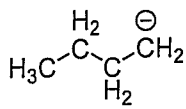
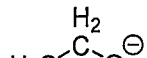
1. Classify the following compounds as an aromatic compound?

(A)  (B)  (C)  (D) 

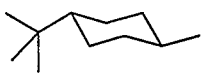
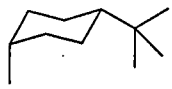
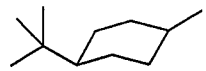
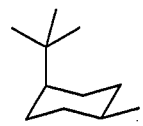
2. The correct name for 

(A) *p*-Nitrosobenzoic acid (B) *p*-Nitrobenzoic acid
(C) *p*-Nitridobenzoic acid (D)4-Nitroxbenzoic acid

3. Which of the following anions is the strongest base?

(A)  (B)  (C)  (D) 

4. Which of the following is the most stable isomer?

(A)  (B)  (C)  (D) 

5. Which signal would you expect to be due to the a-proton of the carbonyl in ethyl acetate?
(A) Singlet at δ 2.00 ppm (B) Triplet at δ 1.20 ppm (C) Quartet at δ 4.00 ppm
(D) Triplet at δ 4.00 ppm

6. Which of the following solvent is suitable to prepare samples for ^{1}H-NMR spectroscopy?
(A) Chloroform (B) Acetone (C) Carbon tetrachloride (D) Water

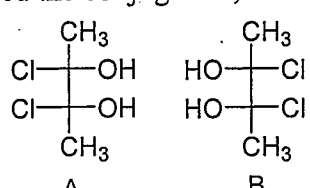
7. Which of the following phenols is the most acidic?
(A) *o*-Chlorophenol (B) *p*-Chlorophenol (C) *o*-Nitrophenol (D) 4-Methylphenol

8. Which method below will reduce triple bond to double bond?
(A) Pd/C, H_2 (B) Pt/C, H_2 (C) Pt/Al_2O_3 (D) $Pd/BaSO_4$, H_2

9. For carbonyl compounds, which type will have the highest absorption frequency in IR spectrum?
(A) aldehyde (B) ketone (C) acid (D) anhydride

10 Which of the following statements is not collect?
(A) In ^{1}H-NMR spectrum, hydrogen atoms having the same chemical shifts do not split each other.
(B) In ^{13}C spectrum, the height of the very narrow peak is not directly related to the number of carbon atoms undergoing that energy transition
(C) A mass spectrum is not a record of energy absorbed by a molecule in going from one energy level to another
(D) Generally, in UV spectrum, the more extended the conjugation, the longer the wavelength at which absorption tale place.

11. A and B is
(A) enantiomers (B) diastereomers
(C) geometric isomers (D) stereoisomers

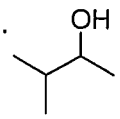
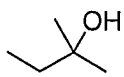
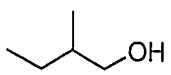


背面有題

試題隨卷繳回

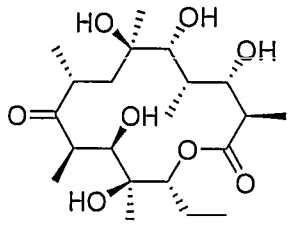
12. Which of the following statements about leaving group is correct?
(A) a good leaving group is usually a string base.
(B) the more electronegative the group, the better it is a leaving group.
(C) the leaving ability of halogens follows $F^- < Cl^- < Br^- < I^-$
(D) none of above

13. In which of the following are the compounds shown listed in order of increasing reactivity to acid-catalyzed dehydration?

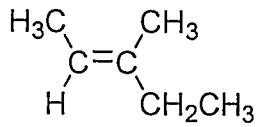
1. 
2. 
3. 

(A) 1 < 2 < 3 (B) 1 < 3 < 2 (C) 2 < 3 < 1 (D) 3 < 1 < 2

14. the species shown right is
(A) an alkaloid
(B) a polyketide
(C) a diterpene
(D) a peptide



15. What is the correct IUPAC name for compound shown right?
(A) *trans*-3-methyl-3-pentene
(B) (*E*)-3-methyl-2-pentene
(C) (*Z*)-3-methyl-2-pentene
(D) (*Z*)-3-ethyl-2-butene



二、問答題：(55%)

1. Explain the following terms (15%, 3% for each)
a. Germinol coupling

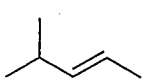
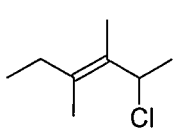
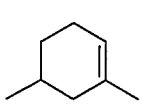
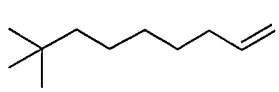
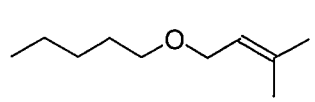
b. McLafferty rearrangement

c. Claisen reaction

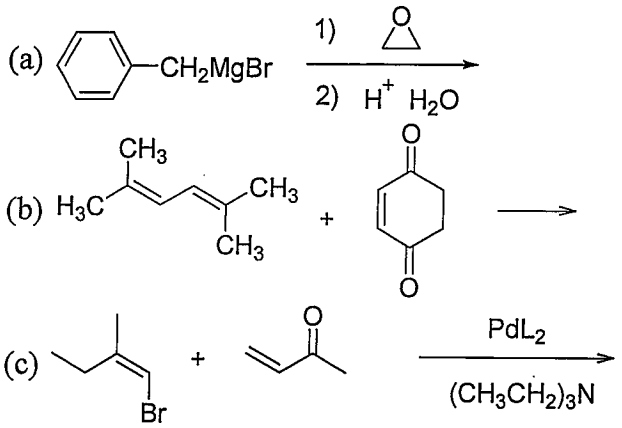
d. Diels-Alder reaction

e. Wagner-Meerwein Rearrangement

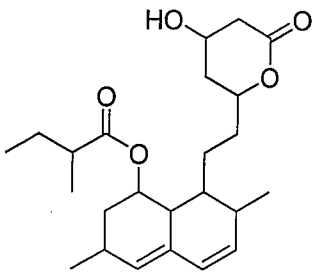
2. Provide IUPAC names for the following compounds. (15%, 3% for each)

a. 
b. 
c. 
d. 
e. 

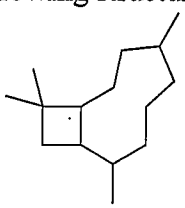
3. Give the expected major product for the following reactions. (9%, 3% for each)



4. Mevacor is used clinically to lower serum cholesterol levels. How many asymmetric centers does Mevacor have? (3%)



5. Please indicate the isoprene units of the following structures (3%)



6. **DETERMINE** and **EXPLAIN** the structure of the compound whose molecular formula is $C_3H_5Cl_3$ for which the mass, IR, ^{1}H NMR, DQFCOSY and ^{13}C/DEPT NMR spectra are given. (10%)

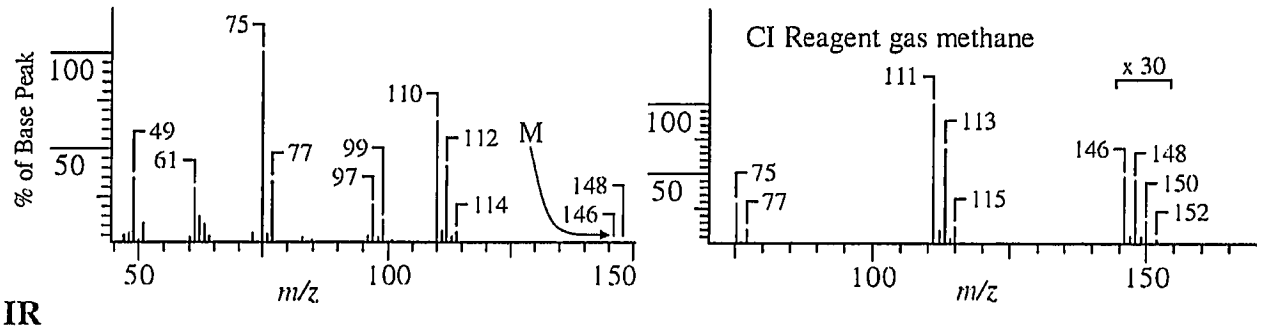
- see the next page

國立中山大學107學年度碩士暨碩士專班招生考試試題

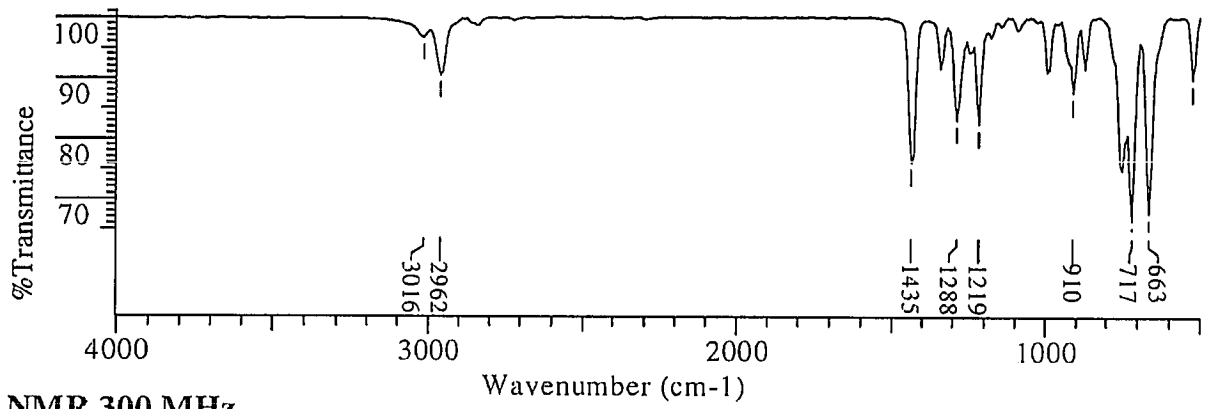
科目名稱：有機化學【海資系碩士班丙組】　　題號：452001

※本科目依簡章規定「不可以」使用計算機(混合題)　　

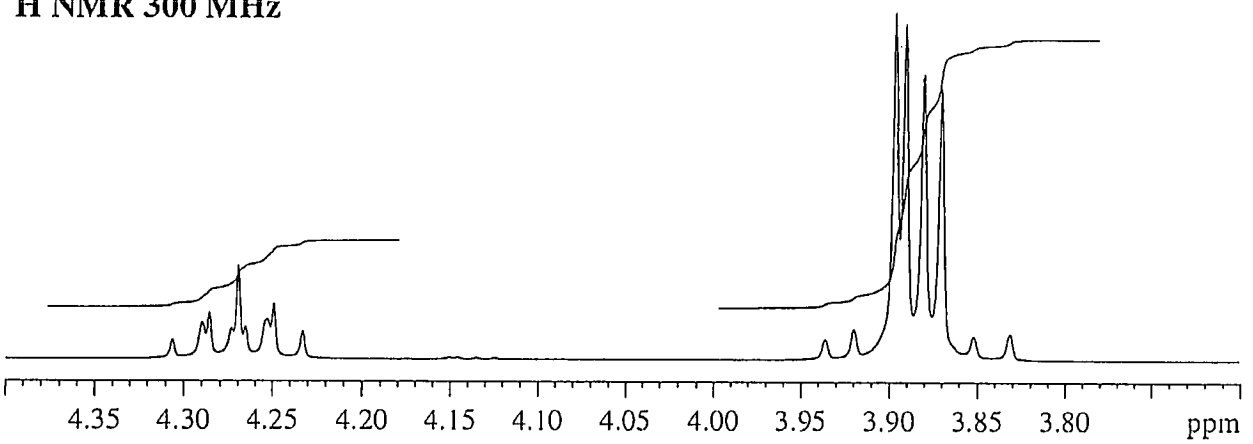
MASS



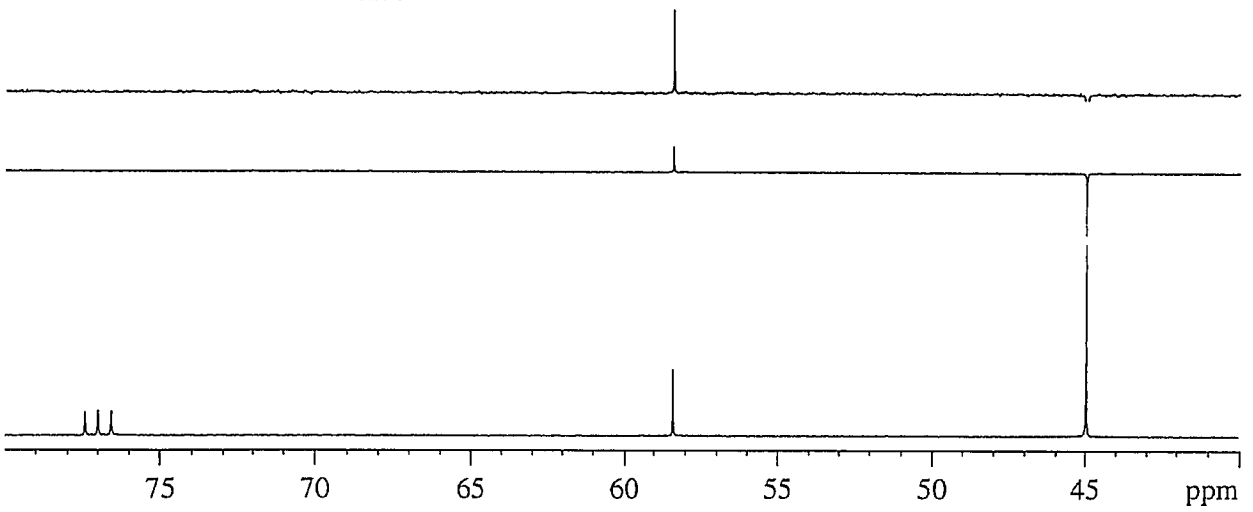
IR



^{1}H NMR 300 MHz



^{13}C/DEPT NMR 75.5 MHz



國立中山大學107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】　　題號：452002

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

簡答題 (每題6分)

1. Please describe the differences and similarities between small interfering RNAs (siRNAs) and micro RNA (miRNA).
2. Please describe the differences and similarities between Synaptic signaling and Neuroendocrine signaling.
3. Please draw a picture to show homeostatic control of body temperature.
4. Please describe the differences between open circulatory system and close circulatory system.
5. Please describe the mechanism of osmoregulation in a marine fish.
6. Please describe the differences between adaptation and acclimation.
7. Please summarize Darwin's idea of "*Descent with modification*".
8. Please describe the different types of interspecific relationships.

解釋名詞 (每題2分)

1. Extracellular matrix (ECM)
2. Aquaporins
3. Osmotic pressure
4. SNPs (single nucleotide polymorphisms)
5. Post-Translational Modifications
6. Excitatory postsynaptic potential
7. Telomerase
8. Housekeeping gene
9. Ligand-gated ion channel
10. Epitope
11. Bottleneck effect
12. Taxon
13. Molecular clock
14. Camouflage
15. Convergent evolution
16. Intermediate disturbance hypothesis

問答題(每題10分)

1. Since Industrial Revolution, the emission of carbon dioxide (CO_2) has significantly increased and caused serious global issues, including global warming and ocean acidification. Please explain the above two phenomena and impacts on marine ecosystems.
2. Please list three marine ecosystems found in Taiwan and describe their environmental and biological characteristics.

試題隨卷繳回

國立中山大學107學年度碩士暨碩士專班招生考試試題

科目名稱：分析化學【海資系碩士班丙組】　　題號：452003

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

請注意:考題中若涉及計算，請將演算過程列出，否則不予計分。

1. Distinguish between
   (a) precision and accuracy. (5%)
   (b) the equivalent point and the end point of a titration. (5%)
   (c) the density and the specific gravity of a solution. (5%)
   (d) a galvanic cell and an electrolytic cell. (5%)

2. What will be the pH of a 1.00×10^{-3} N NaOH solution at 0℃? (Kw at 0℃ is 1.00×10^{-15}) (5%)

3. Suggest a method for the determination of the concentration of H_3PO_4 and NaH_2PO_4 in an aqueous solution. (For H_3PO_4; $pKa_1=2.1$, $pKa_2=7.2$, $pKa_3=12.3$) (10%)

4. According to Beer's law, absorbance is linearly related to the concentration of the absorbing species and the path length of the radiation in the absorbing medium. Identify factors that cause the Beer's law relationship to depart from linearity. (10%)

5. A compound had a molar absorptivity of $2.00\times10^3\ L\cdot cm^{-1}\cdot mol^{-1}$. What concentration of the compound would be required to produce a solution having a transmittance of 10.0% in a 5 cm cell? (5%)

6. Define the following terms for atomic absorption spectroscopy (AAS).
   (a) atomization (5%)
   (b) hollow-cathode lamp (5%)
   (c) drying step (for graphite AAS) (5%)
   (d) charring step (for graphite AAS) (5%)

7. Use activities to calculate the electrode potential of a hydrogen electrode in which the electrolyte is 0.01M HCl and the activity of H_2 is 1.00 atm. (5%)
   Why is it necessary to bubble hydrogen (H_2) through the electrolyte in a hydrogen electrode? (5%)

8. Why do glass pH electrodes tend to indicate a pH lower than the actual pH in strongly basic solution? (5%)
   In strong acid, the measured pH is higher than the actual pH. Why? (5%)

9. A solute with a partition coefficient of 4.0 is extracted from 10 mL of phase1 into phase 2.
   (a) What volume of phase 2 is needed to extract 99% of the solute in one extraction? (5%)
   (b) What is the total volume of phase 2 needed to remove 99% of the solute in two equal extractions instead? (5%)

試題隨卷繳回

國立中山大學107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：452004

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

(1) 請繪圖說明 Antibody 結構。並請標示出哪裡是heavy chain, light chain 及 antigen binding domain (CDR: complementarity-determining region) (10分)。

(2) 請說明真核細胞在蛋白質合成之後轉譯修飾(Post-translational modification)，並舉例說明 (10分)。

(3)請繪圖說明在蛋白質純化過程中，親合性管柱層析法 (affinity chromatography)、離子交換樹脂 (ion exchange chromatography) 以及膠體過濾法 (gelfiltration chromatography)，在功能上有和不同，目的為何? (25分)

(4) 酵素動力論(enzyme kinetics)中，Michaelis-Menten curve如何詮釋K_m, V_{max} 以及基質濃度[S]，請繪圖說明。並繪圖說明 Competitive Inhibition (競爭性抑制)，Noncompetitive Inhibition (非競爭性抑制)以及 Uncompetitive Inhibition (反競爭性抑制) (20分)。

(5) 請列舉胺基酸側鏈 (amino acid side chain) 帶有正電荷、負電荷及不帶電之胺基酸各兩個 (15分)。

(6) 何謂蛋白質二級結構 (secondary structure) ，請繪圖說明 (10分)。

(7) 請說明monoclonal antibodies及polyclonal antibodies有何不同(10分)?

試題隨卷繳回

國立中山大學107學年度碩士暨碩士專班招生考試試題

科目名稱：科學英文【海資系碩士班乙組】　　題號：452006

※本科目依簡章規定「不可以」使用計算機(問答申論題)　　

Reading Comprehension 閱讀能力測驗

Plastics are a contaminant of emerging concern accumulating in marine ecosystems. Plastics tend to break down into small particles, called microplastics, which also enter the marine environment directly as fragments from a variety of sources, including cosmetics, clothing, and industrial processes. Given their ubiquitous nature and small dimensions, the ingestion and impact of microplastics on marine life are a cause for concern, notably for filter feeders. Oysters were exposed to polystyrene microparticles, which were shown to interfere with energy uptake and allocation, reproduction, and offspring performance. A drop in energy allocation played a major role in this reproductive impairment. This study provides ground-breaking data on microplastic impacts in an invertebrate model, helping to predict ecological impact in marine ecosystems.

(引自 Sussarellu et al. 2016 PNAS)

簡答題（**30%**，每題六分。請中文回答）

1. Based on the above article, please list three marine organisms that likely ingest more microplastics.
2. Please explain the major reason for the reducing profit of reproduction in oysters.

Dopamine is produced by *Ulvaria obscura*, a bloom-forming green alga that occurs from the mid intertidal to the shallow subtidal zones of North Pacific and North Atlantic shores. Its concentrations in the alga are approximately 0.5–1% of the alga's fresh mass. When experimentally desiccated and rehydrated at ecologically realistic densities, *Ulvaria* releases dopamine, resulting in seawater dopamine concentrations that can exceed 500 μM. Thus, dopamine could be responsible for previous reports of bioactivity by *Ulvaria exudates*. We tested this hypothesis by measuring the effects of dopamine in seawater on co-occurring macroalgae and crab larvae and juveniles. We ran assays that examined the effects of a range of dopamine concentrations on the growth of the green alga *Ulva lactuca*, on the germination of zygotes of the brown alga *Fucus distichus*, and on the survival, time to metamorphosis and time to first molt of crab (*Metacarcinus magister* and *Cancer oregonensis*) larvae and juveniles. Dopamine began to inhibit *Fucus* germination at concentrations above 5 μM, *Ulva* growth at concentrations above 50 μM, and the survival of *Metacarcinus* zoeae at concentrations above 168 μM. It did not affect the survival of *Cancer* megalopae or juveniles or the time to metamorphosis of megalopae. It had no effect on the time to first molt of *Cancer* juveniles, except at the highest concentration tested (738 μM), where it delayed molting by an average of a day and a half. These toxic effects could have been due to the dopamine or to its oxidation products. We concluded that the large-scale release of dopamine by *U. obscura* following stressful environmental conditions could significantly affect co-occurring species in intertidal pools as well as intertidal and shallow subtidal marine communities where the alga can form large blooms.

(引自 Van Alstyne et al. 2014 Phycologia)

3. What is the hypothesis of this study?
4. What are the toxic effects of *Ulvaria obscura*?
5. What is the stressful environmental factor for *Ulvaria obscura* considered in this article?

For each of the following articles, please (1) translate into Chinese 英翻中, and (2) write ONE summary sentence.

A.

"Human activities impact nearly all parts of the ocean. Lost and discarded nets continue to lethally snare fish, seabirds, and marine mammals as they drift. Ships spill oil and garbage and transport critters to alien habitats unprepared for their arrival. Mangrove forests are cleared for homes and industry. More than

half of the U.S. population lives in coastal areas, spilling garbage and sewage into the ocean. Fertilizer runoff from farms turns vast swaths of the ocean into dead zones, including a New Jersey-size area in the Gulf of Mexico. The greenhouse gas carbon dioxide is turning ocean waters acidic, and an influx of freshwater from melting glaciers threatens to alter the weather-driving currents." (25%)

[Quoted from: National Geography]

B.

"The World Conservation Union is now warning the world of a "global extinction crisis," claiming nearly 40 percent of all of Earth's species are now at the highest risk of extinction. More than one third of all fish are threatened; as are just under a third of all reptiles and amphibians and 20 percent of all mammals." (20%)

[Quoted from: Rachel Oliver, CNN]

Please translate the following paragraph into English 中翻英.

C. 海洋占地球表面面積71%，包含多樣的生態系統，為植物和動物提供了生活環境，且是人類食物的一個主要來源，對維繫地球上的生命，提供了不可缺少的生存條件。託四面環海之便，台灣其實擁有利用海水資源的優勢。然而，近幾十年來，由於在陸地上的活動，海洋環境的健康和生產能力都面臨重大威脅。值得注意的是，海洋中的絕大部分汙染物，大都來自陸地活動，這些汙染物對人體健康和海洋生物資源都帶來極大威脅。臺灣為四面環海的島國，幾乎每個縣都有接觸到海洋，居民的生活與海洋息息相關；因此，海洋資源的遭受破壞及威脅，都將直接或間接地對臺灣帶來衝擊。而海洋資源的保護工作是極為複雜的問題，必須採取及結合各類性質不同的措施，以求海洋能夠永續發展，資源不虞匱乏。 (25%)

〔摘錄自楊荏婷國政研究報告網站〕