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：有機化學及無機化學【化學系碩士班】　　題號：422001

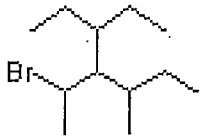
※本科目依簡章規定「不可以」使用計算機　　

(一) 選擇題 (20 %)

There is only one correct answer for each question. (2% x 10 = 20%)

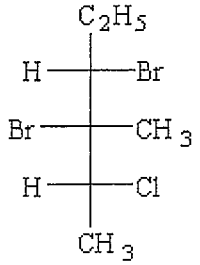
(1). Calculate the molecular formula for the organic compound whose quantitative elemental analysis showed 48.6% carbon and 8.1% hydrogen by weight.
(A) CH_2O (B) $C_2H_4O_2$ (C) C_2H_6 (D) C_3H_6O (E) $C_3H_6O_2$

(2). Identify the correct IUPAC name for the compound shown below.



(A) 2-bromo-3-*sec*-butyl-4-ethylhexane (B) 2-bromo-4-ethyl-3-*sec*-butylhexane
(C) 3-(1-bromoethyl)-2,4-diethylhexane (D) 4-(1-bromoethyl)-3-ethyl-5-methylheptane
(E) 4-(1-bromoethyl)-5-ethyl-3-methylheptane

(3). What is the IUPAC name of the compound shown below?



(A) (2R,3S,4S)-2-chloro-3,4-dibromo-3-methylhexane
(B) (2R,3S,4S)-3,4-dibromo-2-chloro-3-methylhexane
(C) (3S,4S,5S)-3,4-dibromo-5-chloro-4-methylhexane
(D) (2R,3R,4S)-3,4-dibromo-2-chloro-3-methylhexane
(E) (2R,3S,4R)-3,4-dibromo-2-chloro-3-methylhexane

(4). Which of the following is true for the termination step of a free radical chlorination reaction?
(A) $\Delta H° > 0$ and $\Delta S° > 0$ (B) $\Delta H° > 0$ and $\Delta S° < 0$ (C) $\Delta H° < 0$ and $\Delta S° > 0$
(D) $\Delta H° < 0$ and $\Delta S° < 0$ (E) $\Delta H° = 0$ and $\Delta S° = 0$

(5). Which of the following compounds will undergo an S_N2 reaction most readily?
(A) $(CH_3)_3CCH_2I$ (B) $(CH_3)_3CCl$ (C) $(CH_3)_2CHI$
(D) $(CH_3)_2CHCH_2CH_2CH_2I$ (E) $(CH_3)_2CHCH_2CH_2CH_2Cl$

(6). Which of the following alkenes has the largest molar heat of hydrogenation (ie, releases the most heat upon hydrogenation)?
(A) 2,3-dimethyl-2-butene (B) 2-methyl-2-butene
(C) trans-2-butene (D) cis-2-butene (E) 1-hexene

(7). The mass spectrum of which compound has M^+ and M^{+2} peaks of approximately equal intensity?
(A) 3-bromopentane (B) 3-pentanol (C) pentane
(D) 3-chloropentane (E) 3-iodopentane

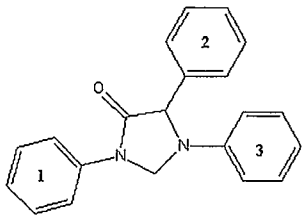
(8). Describe the number of signals and their splitting in the ^{1}H NMR spectrum of $(CH_3)_2CHOCH_3$.

(A) 3 signals: 2 doublets and a septet
(B) 2 signals: a doublet and a septet
(C) 3 signals: a doublet, a quartet, and a septet
(D) 4 signals: 2 doublets, a singlet, and a septet
(E) 3 signals: a singlet, a doublet, and a septet

(9). In electrophilic aromatic substitution reactions, a bromine substituent:

(A) is a deactivator and a m-director.
(B) is a deactivator and an o,p-director.
(C) is an activator and a m-director.
(D) is an activator and an o,p-director.
(E) none of the above

(10). Derivatives of the compound shown below are currently being examined for their effectiveness in treating drug addiction and metabolic syndrome (*J. Med. Chem.* **2006**, 872). Which sequence ranks the following aromatic rings of this compound in order of increasing reactivity in an electrophilic aromatic substitution reaction (slowest to fastest reacting)?



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

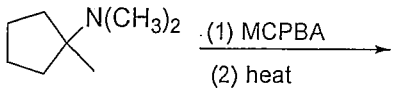
國立中山大學102學年度碩士暨碩士專班招生考試試題

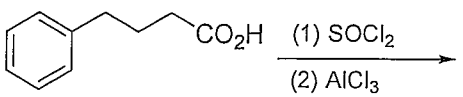
科目名稱：有機化學及無機化學【化學系碩士班】　　題號：422001

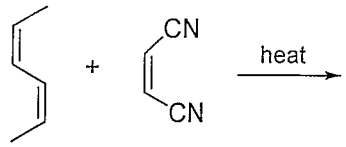
※本科目依簡章規定「不可以」使用計算機　　

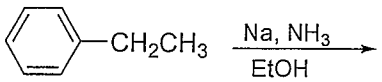
(二) 非選擇題 (80 %)

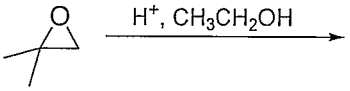
1. Predict the main product of the following reactions (Be specific about stereochemistry). (3% x 5 = 15%)

(a) 

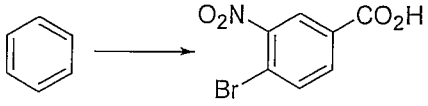
(b) 

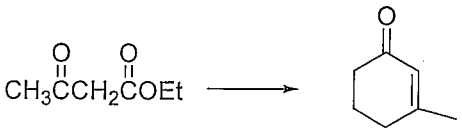
(c) 

(d) 

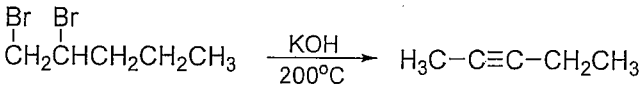
(e) 

2. Accomplish the following syntheses. (5% x 2 = 10%)

(a) 

(b) 

3. Propose a reasonable mechanism for the following reaction (5% x 1 = 5%)



4. 請解釋/回答下列各小題 (10 小題；每小題 5 分；共 50 分)

(a) Inner-sphere mechanism of redox reactions
(b) Berry pseudorotation (for five-coordination complexes)
(c) Zintle phases
(d) Endohedral fullerenes
(e) Water gas shift reaction
(f) Draw the structure for Al_2Me_6
(g) Determine the point group for $[Ru(NH_2CH_2CH_2NH_2)_3]^{2+}$
(h) '**Leveling Effect**' in acid-base chemistry
(i) LMCT bands of electronic spectra
(j) Draw the structure for cisplatin