113OP01

國立臺北科技大學113學年度碩士班招生考試

系所組別：3700 分子科學與工程系有機高分子碩士班

第一節　有機化學　試題

注意事項：

1. 本試題共二大題，每題 50 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

第一大題 單選題 (共 10 小題，每小題 5 分，共計 50 分)

1. (　) Consider the S_N1 reaction of *tert*-butyl bromide with iodine ion,

$(CH_3)_3C\text{-}Br + I^- \rightarrow (CH_3)_3C\text{-}I + Br^-$

If the concentration of iodide ion is **doubled**, the rate of forming *tert*-butyl bromide will: (*hint: consider mechanism, i.e. how is the product formed?*)

(A) Double.
(B) Increase 4 times.
(C) Remain the same.
(D) Decrease.

2. (　) The heat of combustion (*per* CH_2) of several cycloalkanes is listed below. Based on the data given, which of these cycloalkanes would be considered **the most stable**.

Heat of combustion (kJ/CH_2)	Cycloalkanes
-686.5	cyclobutene
-664.0	cyclopentane
-663.0	cyclooctane
-659.0	cyclopentadecane

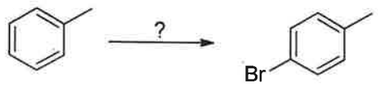
(A) Cyclobutene.
(B) Cyclopentane.
(C) Cyclooctane.
(D) Cyclopentadecane.

3. (　) Which is the order from the strongest acid to the weakest acid for these species?

CH_3OH	$CH_3OH_2^+$	CH_3NH_2	$CH_3NH_3^+$
I	**II**	**III**	**IV**

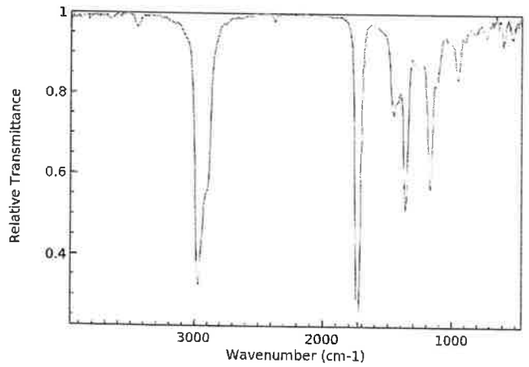
(A) **II > IV > I >III.**
(B) **III > I > IV >II.**
(C) **III > IV > I >II.**
(D) **II > I > IV > III.**

4. (　) Which set of reagents would most likely bring about this transformation?



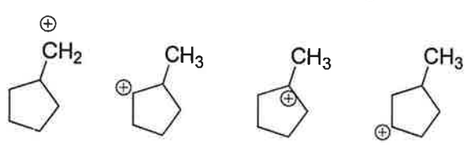
(A) Br_2 with $FeBr_3$.
(B) Br_2 in CCl_4.
(C) Br_2 with UV light.
(D) NaBr with H_2SO_4.

5. (　) Which is the reasonable compound for a compared with this IR spectrum?



(A) Pentan-2-one.
(B) Pentanal.
(C) Pentane.
(D) Pentan-2-ol.

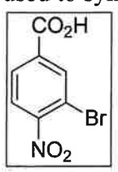
6. (　) Predict which of the following carbocations has the highest energy,

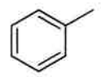


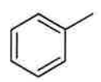
(A)　(B)　(C)　(D)

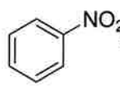
注意：背面尚有試題

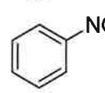
7. (　) Which reaction sequence might be used to synthesize this compound?



(A)  HNO_3, H_2SO_4 → 1) $KMnO_4$, NaOH, △; 2) H_2O, H^+ → Br_2, $FeBr_3$

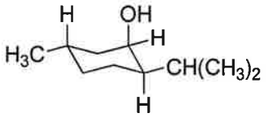
(B)  HNO_3, H_2SO_4 → Br_2, $FeBr_3$ → 1) $KMnO_4$, NaOH, △; 2) H_2O, H^+

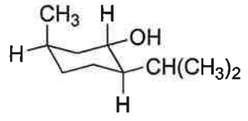
(C)  NO_2; Br_2, $FeBr_3$ → CH_3Cl, $AlCl_3$ → 1) $KMnO_4$, NaOH, △; 2) H_2O, H^+

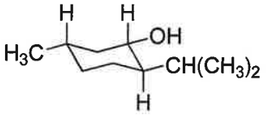
(D)  NO_2; CH_3Cl, $AlCl_3$ → 1) $KMnO_4$, NaOH, △; 2) H_2O, H^+ → Br_2, $FeBr_3$

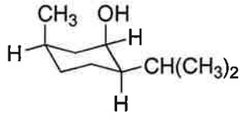
8. (　) Why would the concentrated hydrobromic acid be an inappropriate catalyst for the dehydration of alcohols?
(A) HBr is too weakly acidic to protonate the alcohol.
(B) The conjugate base, Br^-, is a good nucleophile and it would attack the carbocation to form an alkyl bromide.
(C) HBr is strongly acidic, so the water molecule would not be a good leaving group after the protonation of the alcohol.
(D) HBr would be more likely to promote rearrangement of the carbocation intermediate.

9. (　) Which diastereoisomer is the most stable?

(A) 

(C) 

(B) 

(D) 

10. (　) The specific rotation of pure (R)-2-butanol is -13.5°. What% of a mixture of the two enantiomeric forms is (S)-2-butanol if the specific rotation of this mixture is -5.4°?
(A) 40%.
(B) 30%.
(C) 60%.
(D) 70%.

第二大題 簡答題 (共 4 小題，共計 50 分)

1. Draw structures corresponding to the following IUPAC names. (10 pts)
(A) 5,5-Dimethyl-3-hexanol.
(B) 5-Bromo-4-methyl-3-heptanone.
(C) 3,5-Dimethylphenol.
(D) 3-Ethyl-2,2-dimethylhept-3-ene.
(E) Hexa-2,4-diyne.

2. Match the polymers given in **Column I** with their chemical names given in **Column II**. (10 pts)

Column I	**Column II**
(i) Nylon 6	(a) Polyvinyl chloride
(ii) PVC	(b) Polyacrylonitrile
(iii) Acrlian	(c) Polycaprolactum
(iv) Natural rubber	(d) Low density polythene
(v) LDP	(e) cis-Polyisoprene

3. Devise a simple chemical test for distinguishing between the following pairs of compounds: (20 pts)
(A) Cyclohexane and cyclohexene.
(B) 1-Chlorobutane and 1-bromobutane.
(C) Butanoic acid and ethyl ethanoate.
(D) Propan-2-ol and 2-methylpropan-2-ol.
(E) 2-Methylpropan-2-ol and ethoxyethane.

4. Give the bond dissociation energies below (in kcal/mol), and calculate the overall ΔH° for the following reaction:
$(CH_3)_3CH + Br_2 \rightarrow (CH_3)_3CBr + HBr$
$(CH_3)_3CH$　91 kcal/mol
$(CH_3)_3CBr$　65 kcal/mol
Br-Br　46 kcal/mol
H-Br　88 kcal/mol
CH_3-Br　88 kcal/mol
Write chain propagation steps for the above bromination reaction. (10 pts)