

國立臺北科技大學
九十七學年度研究所碩士在職專班(含EMBA)入學考試

有機高分子研究所
甲組：有機化學(含光譜分析) 試題

填准考證號碼

第一頁 共四頁

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注意事項：

1. 本試題共【22; (A:1-20, B, C)】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。

A. (80 pt; 1-20: 4 pt each; single choice)

1. Consider the S_N2 reaction of butyl bromide with OH ion.



Assuming no other changes, what effect on the rate would result from simultaneously doubling the concentrations of both butyl bromide and OH- ion?

- A) No effect.
- B) It would double the rate.
- C) It would triple the rate.
- D) It would increase the rate four times.
- E) It would increase the rate six times.

2. Select the rate law for a second order reaction, e.g.,



- A) $\text{Rate} = k [\text{RX}]$
- B) $\text{Rate} = k [\text{RX}] [\text{OH}^-]$

C) $\text{Rate} = k [\text{RX}]^2 [\text{OH}^-]$

D) $\text{Rate} = k [\text{RX}] [\text{OH}^-]^2$

E) $\text{Rate} = k [\text{RX}]^2 [\text{OH}^-]^2$

3. Increasing the temperature of a chemical reaction usually increases greatly the rate of the reaction. The most important reason for this is that increasing the temperature increases:
- A) the collision frequency.
 - B) the probability factor.
 - C) the fraction of collisions with energy greater than E_{act} .
 - D) the energy of activation.
 - E) the amount of heat released in the reaction.

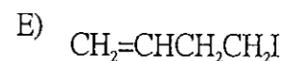
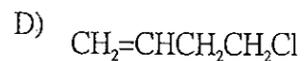
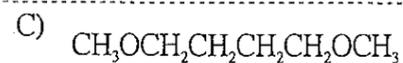
4. The rate equation for an S_N1 reaction of an alkyl bromide (R-Br) with I⁻ ion would be:

- A) $\text{Rate} = k [\text{RBr}]$
- B) $\text{Rate} = k [\text{I}^-]$
- C) $\text{Rate} = k [\text{RBr}][\text{I}^-]$
- D) $\text{Rate} = k [\text{RBr}]^2 [\text{I}^-]$
- E) $\text{Rate} = k [\text{RBr}][\text{I}^-]^2$

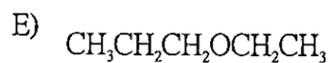
5. When 0.10 mol of $\text{ICH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$ reacts with 0.10 mol of NaOCH_3 in CH_3OH at 40°C , the major product is:

- A) $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$
- B) $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{I}$

注意：背面尚有試題



6. In a 60:40 mixture of ethanol and water at room temperature are dissolved 0.10 mol of $\text{CH}_3\text{CH}_2\text{CH}_2\text{OSO}_2\text{CH}_3$ and 0.10 mol each of NaCl, NaI, NaF and NaBr. What is the principal product of the subsequent reaction?



7. $\text{S}_{\text{N}}2$ reactions of the type, $\text{Nu} + \text{RL} \rightarrow \text{Nu-R} + \text{L}$, are favored:

- A) when tertiary substrates are used.
- B) by using a high concentration of the nucleophile.
- C) by using a solvent of high polarity.
- D) by the use of weak nucleophiles.
- E) by none of the above.

8. Which of the following statements is (are) true of $\text{S}_{\text{N}}1$ reactions of alkyl halides in general?

- A) The rate of an $\text{S}_{\text{N}}1$ reaction depends on the concentration of the alkyl halide.

B) The rate of an $\text{S}_{\text{N}}1$ reaction depends on the concentration of the nucleophile.

C) $\text{S}_{\text{N}}1$ reactions of alkyl halides are not favored by polar solvents.

D) Answers A) and C) only are true.

E) Answers A), B) and C) are true.

9. $\text{S}_{\text{N}}1$ reactions of the type, $\text{Nu} + \text{RL} \rightarrow \text{Nu-R} + \text{L}$, are favored:

A) when tertiary substrates are used.

B) by using a high concentration of the nucleophile.

C) when L is a strong base.

D) by use of a non-polar solvent.

E) by none of the above.

10. What is the total number of pentyl alcohols, including stereoisomers?

A) 7

B) 8

C) 9

D) 10

E) 11

11. Concerning the relative stabilities of alkenes, which is an untrue statement?

A) Unless hydrogenation of the alkenes gives the same alkane, heats of hydrogenation cannot be used to measure their relative stabilities.

B) In general, the greater the number of alkyl groups attached to the carbon atoms of the double bond, the greater the stability of the alkene.

C) The greater the quantity of heat liberated on combustion or hydrogenation of an alkene, the greater its energy content.

D) trans-Cycloalkenes are always more stable than the cis-isomers.

E) Heats of combustion can be used to measure the relative stabilities of isomeric alkenes, even though their hydrogenation products are not identical.

12. Which of the following correctly lists the compounds in order of decreasing acidity?

- A) $\text{H}_2\text{O} > \text{HC}\equiv\text{CH} > \text{NH}_3 > \text{CH}_3\text{CH}_3$
- B) $\text{HC}\equiv\text{CH} > \text{H}_2\text{O} > \text{NH}_3 > \text{CH}_3\text{CH}_3$
- C) $\text{CH}_3\text{CH}_3 > \text{HC}\equiv\text{CH} > \text{NH}_3 > \text{H}_2\text{O}$
- D) $\text{CH}_3\text{CH}_3 > \text{HC}\equiv\text{CH} > \text{H}_2\text{O} > \text{NH}_3$
- E) $\text{H}_2\text{O} > \text{NH}_3 > \text{HC}\equiv\text{CH} > \text{CH}_3\text{CH}_3$

13. Select the strongest base.

- A) OH^-
- B) $\text{RC}\equiv\text{C}^-$
- C) NH_2^-
- D) $\text{CH}_2=\text{CH}^-$
- E) CH_3CH_2^-

14. Which of the following statements is true when ethane, ethene and acetylene are compared with one another?

- A) Acetylene is the weakest acid and has the longest C-H bond length.
- B) Acetylene is the strongest acid and has the shortest C-H bond length.
- C) Ethane is the strongest acid and has the longest C-H bond length.
- D) Ethene is the strongest acid and has the shortest C-H bond length.
- E) Ethene is the weakest acid and has the longest C-H bond length.

15. Which of the following would be soluble in cold concentrated sulfuric acid, decolorize bromine in carbon tetrachloride, and exhibit IR absorption at about 3300

cm⁻¹ ?

A) $\text{CH}_3\text{CH}=\text{CHCH}_3$

B) $\text{CH}_3\text{CH}=\text{CH}_2$

C) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$

D) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

E) All of these would give positive results in each test.

16. How many ethers with the formula $\text{C}_4\text{H}_{10}\text{O}$ are possible?

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

17. The number of optically active pentyl alcohols, i.e., the total number of individual enantiomers, is:

- A) 0
- B) 2
- C) 3
- D) 4
- E) 6

18. Which reagent or test could be used to distinguish between 2-pentyne and 1-pentyne?

- A) Br_2/CCl_4
- B) IR examination
- C) Concd. H_2SO_4

- D) $\text{KMnO}_4, \text{OH}^-$
- E) None of these
19. Which reagent or test could be used to distinguish between 1-bromohexane and hexane?
- A) Br_2/CCl_4
- B) IR examination
- C) dilute KMnO_4
- D) cold concd. H_2SO_4
- E) None of these
20. Which of the following could be used to distinguish between 1-octyne and 2-octyne?
- A) Treatment with 2 mol of HX
- B) Addition of water
- C) Reaction with KMnO_4
- D) Decolorization of bromine in CCl_4
- E) IR examination

B (10 pt)

A compound $\text{C}_4\text{H}_9\text{Br}$ gave the following ^1H NMR spectrum:

multiplet, δ 4.1 (1H); multiplet, δ 1.8; doublet, δ 1.7;
triplet, δ 1.0 (3H)

Which is a reasonable structure for the compound?

C. (10 pt)

A compound with the molecular formula $\text{C}_4\text{H}_{10}\text{O}$ gives a ^1H NMR spectrum consisting only of a quartet centered at $\delta = 3.5$ and a triplet at $\delta = 1.1$. What is its structure?