

國立臺北科技大學
九十八學年度研究所碩士在職專班入學考試

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

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注意事項：

1. 本試題共【兩大】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。

Organic exam

Two Parts: Part A (90 points; 3 pt each), Part B (10 points)

Please write your answer on the answer sheet(s).

Part A (90 points; 3 pt each)

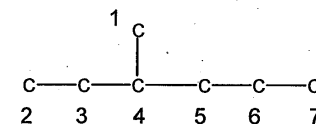
1. The method used to rearrange straight-chain hydrocarbons into branched or aromatic hydrocarbons which burn better in internal combustion engines is called
 - a. simple distillation.
 - b. pyrolysis.
 - c. fractional distillation.
 - d. catalytic reforming.
 - e. catalytic cracking.
2. Reformulated gasolines
 - a. eliminate pollution caused by lead in other gasoline formulations.
 - b. contain oxygenated compounds.
 - c. contain more aromatic compounds than other gasoline formulations.
 - d. have both properties a and b above.
 - e. have both properties a and c above.
3. Which of these pollutants are associated with gasoline and its combustion?
 - a. carbon monoxide
 - b. nitrogen oxides
 - c. ozone
 - d. hydrocarbons
 - e. all of the above

4. Which of the following is a component of natural gas?
 - a. benzene
 - b. butane
 - c. butanol
 - d. octane
 - e. propanol
5. The first stage in extracting aromatic hydrocarbons from coal is called
 - a. catalytic cracking.
 - b. catalytic reforming.
 - c. combustion.
 - d. fractional distillation.
 - e. pyrolysis.
6. The fuel value of a particular fuel can be calculated by dividing _____ by _____.
 - a. the quantity of energy in kJ released on burning a sample; the cost of the sample in \$/L
 - b. its retail price in \$/L; its octane rating
 - c. the quantity of energy in kJ released on burning a sample; the volume of the sample in L
 - d. the volume of usable fuel in L; the volume of crude oil (in L) used to produce the fuel
 - e. the quantity of energy in kJ released on burning a sample; the mass of the sample in g
7. The energy density of a particular fuel is
 - a. the quantity of energy released per gram of fuel.
 - b. the ratio of its retail price to its octane rating.
 - c. the ratio of usable fuel to the volume of crude oil used to produce the fuel.
 - d. a description of the efficiency of its combustion.
 - e. the quantity of energy released per unit volume of fuel.
8. One fuel (A) has a higher fuel value than another (B). If samples of A and B yield the same amount of energy on combustion, then the sample of A must _____ than the sample of B.
 - a. weigh less
 - b. have a smaller volume
 - c. cost less
 - d. cost more
 - e. weigh more
9. Which of these is unlikely to help alleviate global warming?
 - a. reducing combustion of fossil fuels
 - b. reducing forest clearing for agriculture
 - c. using only unleaded gasoline
 - d. increasing the use of nuclear power generation
 - e. planting more trees
10. The greenhouse gas that is believed to have the greatest influence on global warming is
 - a. nitrogen.
 - b. ozone.
 - c. water vapor.
 - d. carbon dioxide.
 - e. methane.
11. Which of the following processes remove carbon dioxide from the atmosphere?
 - I Combustion
 - II Dissolving in water
 - III Photosynthesis
 - IV Respiration
 - a. I and II
 - b. III and IV
 - c. I and IV
 - d. II and III
 - e. all four
12. How many of these are greenhouse gases: oxygen, methane, nitrogen, ozone, water vapor?
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5

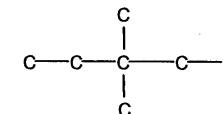
注意：背面尚有試題

13. Greenhouse gases in the atmosphere contribute to global warming mainly by
- absorbing ultraviolet light energy from the sun and emitting it as infrared radiation.
 - absorbing ultraviolet light energy from the sun and storing it as molecular vibrations.
 - absorbing infrared light energy from the sun and storing it as molecular vibrations.
 - absorbing ultraviolet light energy from the earth and storing it as molecular vibrations.
 - absorbing infrared light energy from the earth and storing it as molecular vibrations.
14. The synthesis of urea from ammonium cyanate was accomplished by Wohler in 1828. This is important because
- urea is expensive to synthesize by other routes.
 - it disproved the Vital Force hypothesis
 - it provided an inexpensive route for nitrogen fixation.
 - it confirmed the biological mechanism of detoxification of this noted poison.
 - it demonstrated the ability of carbon to form stable C-C bonds.
15. Which of the following is not usually used as a starting material for the production of other products?
- benzene
 - gasoline
 - ethylene
 - acetylene
 - propylene
16. Consider the carbon skeleton shown below. If a(n) _____ group is attached to carbon 2, a _____ alcohol will result; if the group is attached to carbon 3, a _____ alcohol will result.
-
- hydroxyl; secondary; tertiary
 - carboxyl; primary; secondary
 - hydroxyl; primary; secondary
 - carbonyl; secondary; primary
 - hydroxyl; tertiary; secondary
17. All alcohols contain the functional group
- NH₂OH
 - CH₂OH
 - CO₂H
 - CHO
 - OH
18. Which is not a use of alcohols?
- solvent
 - moisturizer
 - fuel
 - flavoring
 - antifreeze
19. The major alcohol produced by fermentation of carbohydrates is
- 1-butanol.
 - ethanol.
 - ethylene glycol.
 - glycerol.
 - methanol.
20. Consider the carbon skeleton shown below. To form a primary alcohol, the functional group can be bonded to which carbon atom(s)?

- 4
- 2 or 6
- 3, 5, or 6
- 1, 2, or 7
- any of them



21. How many **different** secondary alcohols can be made from the carbon skeleton shown below?
- 0
 - 1
 - 2
 - 3
 - 4



22. In the first step of oxidation of alcohols, primary alcohols produce _____, secondary alcohols produce _____, and tertiary alcohols produce _____.
- aldehydes; ketones; no reaction
 - aldehydes; no reaction; ketones
 - ketones; aldehydes; no reaction
 - ketones; no reaction; aldehydes
 - no reaction; aldehydes; ketones
23. A primary alcohol oxidizes in two stages to produce a(n) _____. This same product can also be obtained by oxidation of a(n) _____.
- tertiary alcohol ; secondary alcohol
 - aldehyde; secondary alcohol
 - carboxylic acid ; aldehyde
 - aldehyde; ketone
 - carboxylic acid ; ketone
24. The functional group in which the carbon atom at one end of the molecule has a double bond to oxygen and a single bond to hydrogen is the _____ functional group.
- secondary alcohol
 - primary alcohol
 - tertiary alcohol
 - aldehyde
 - ketone
25. Which of these functional groups contains a carbon atom doubly bonded to an oxygen atom?
- aldehyde
 - ketone
 - alcohol
 - both a and b
 - both b and c
26. How many of these functional groups contain either a carbon atom doubly bonded to an oxygen atom, a hydrogen atom singly bonded to an oxygen atom, or both: alcohol, aldehyde, carboxylic acid, ketone?
- 0
 - 1
 - 2
 - 3
 - 4

27. Consider three molecules of similar molecular weight, one a hydrocarbon, another a primary alcohol, and the third a carboxylic acid. In *decreasing* order, their boiling points are
a. acid, alcohol, hydrocarbon b. acid, hydrocarbon, alcohol c. alcohol, acid, hydrocarbon
d. hydrocarbon, acid, alcohol e. hydrocarbon, alcohol, acid
28. If a polymer is said to be thermoplastic, this means that it
a. will never become fluid upon heating. b. will become fluid only once upon heating.
c. will not be brittle even at very low temperatures. d. will become fluid repeatedly upon heating.
e. will not decompose at any temperature.
29. A polymer that returns to its original size and shape after being stretched is said to be
a. copolymerized b. elastomeric c. polyesterified d. rubberized e. vulcanized
30. "Polyester" (poly(ethylene terephthalate)) is produced by a(n) _____ reaction between terephthalic acid and _____.
a. addition; ethylene b. condensation; ethylene glycol c. addition; ethylene diamine
d. disproportionation; ethylene glycol e. condensation; ethylene

Part B (10 points)

An aliphatic compound C_4H_9Br 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 the structure for the compound (please draw the structure)?