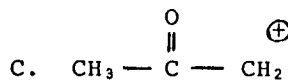
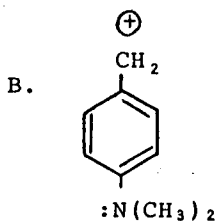
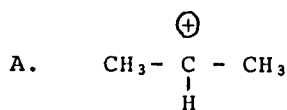
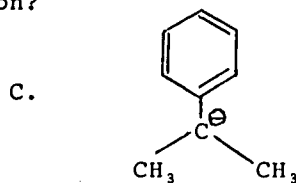
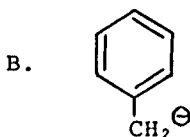
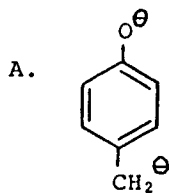


(I) 選擇題(每題 2 分, 答錯倒扣 0.5 分, 均為單選)

1. Which of the following is the most stable carbocation?

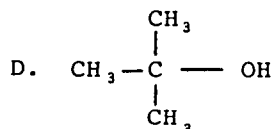


2. Which of the following is the least stable carbanion?

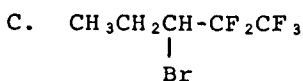
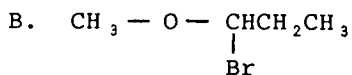
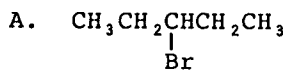


3. Which compound reacts most rapidly with sodium metal?

- A. Cyclohexanol
B. Ethanol
C. $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$



4. Which of the following molecules will ionize most rapidly under polar conditions?

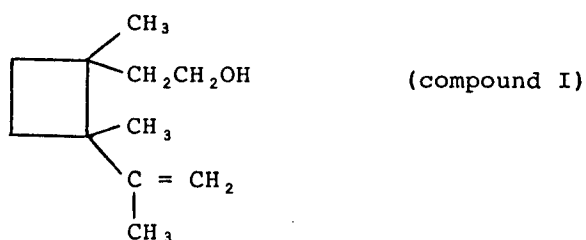


5. For cis-1,4-dimethylcyclohexane, which of the following statements is correct?

- A. It can be optically active.
B. It is dissymmetric.
C. The boat form is the most stable conformer.
D. It interconverts to an identical conformer.
E. It interconverts to a non-identical conformer.

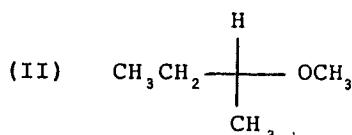
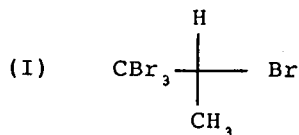
203

6. The sex attractant (compound I) of the male boll weevil has been synthesized. What is the total number of possible stereoisomers for this compound?



- A. 1 B. 2 C. 4 D. 8 E. 16

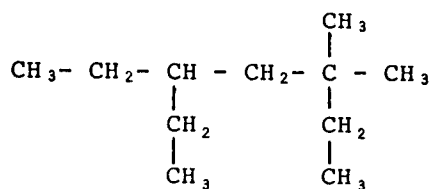
7. Consider the Fischer projections of compounds I and II. Concerning the configurations at the asymmetric carbons, which of the following absolute configurational assignments is correct?



I II

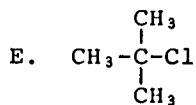
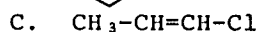
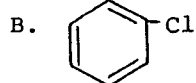
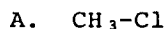
- A. R R
B. R S
C. S R
D. S S
E. None of the above
8. Ionic bonding would be expected to occur between which of the following pairs of elements?
- A. I and Cl
B. H and O
C. Na and Br
D. C and O
E. N and H
9. Which of the following is NOT a characteristic of organic compounds?
- A. Bonds which bind the atoms together are nearly always of the covalent type.
B. They usually have low melting points.
C. They usually are only slightly soluble or insoluble in water.
D. The unit particles are ions and not distinct molecules.
E. If water-soluble they seldom conduct an electric current.
10. The general designation for a Grignard reagent is
- A. RMgX
B. R₂Mg
C. RXMg
D. MgX₂
E. RMgR

11. What is the IUPAC name for

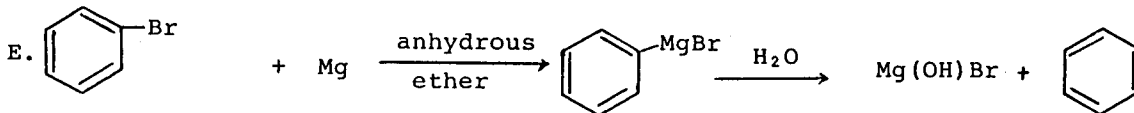
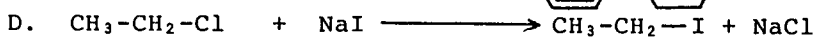
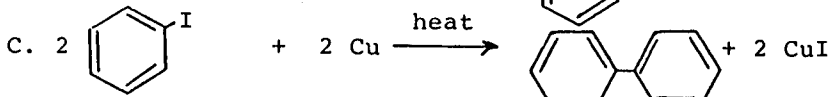
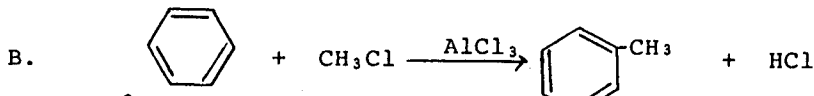
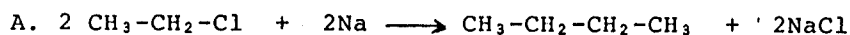


- A. 2-methyl-2,4-diethylhexane
B. 2-ethyl-5,5-dimethylheptane
C. 3,5-diethyl-5-methylhexane
D. 5-ethyl-3,3-dimethylheptane
E. 2,2-dimethyl-5-ethylheptane
12. A triple bond consists of
- A. 2 sigma bonds and 1 pi bond
B. 3 sigma bonds
C. 1 sigma bond and 2 pi bonds
D. 3 pi bonds
E. none of the above

13. Which compound reacts most rapidly by an S_N1 mechanism?



14. An example of the Friedel-Crafts reaction is



15. Which of the following is NOT a true statement about S_N1 reactions?

- A. The formation of a carbocation is the rate-determining step.
- B. Primary alkyl halides seldom, if ever, react by this mechanism.
- C. An increase in concentration of either of the reactants will increase the rate of the reaction.
- D. The designation S_N1 means substitution, nucleophilic, unimolecular.
- E. An elimination reaction leading to an alkene is a competing reaction.

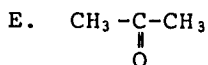
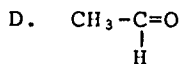
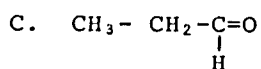
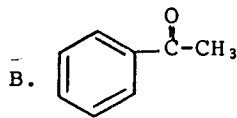
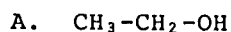
16. An unknown compound is soluble in cold concentrated sulfuric acid, but insoluble in sodium hydroxide. It does not decolorize bromine and does not react with metallic sodium. The class of compounds to which the unknown belongs is

- A. alkanes
- B. alkenes
- C. alcohols
- D. phenols
- E. ethers

17. Which of the following, on oxidation, yields a compound of formula $\text{C}_4\text{H}_8\text{O}$ that gives a negative result with Fehling's or Tollens' reagent?

- A. $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-OH}$
- B. $\text{CH}_3\text{-CH}_2\text{-CH-CH}_3$
 |
 OH
- C. $(\text{CH}_3)_2\text{-CH-CH}_2\text{-OH}$
- D. $\text{CH}_3\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$
- E. none of the above

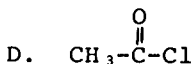
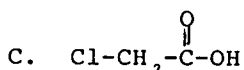
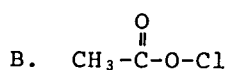
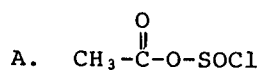
18. An unknown compound gave a positive Tollens' test. Treatment of the unknown with iodine and sodium hydroxide gave a solid which was identified as iodoform. The unknown was which of the following compounds?



19. Which reaction DOES NOT yield an ester as one of the products?

- A. carboxylic acid is heated with an alcohol in the presence of a mineral acid.
- B. A Grignard reagent is added to a carboxylic acid.
- C. An acyl halide is treated with an alcohol.
- D. An acid anhydride is treated with an alcohol.
- E. An alkyl halide is heated with the salt of a carboxylic acid.

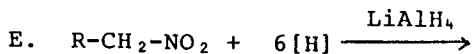
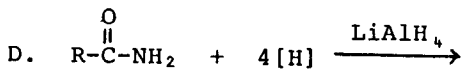
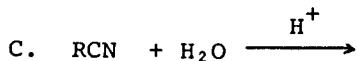
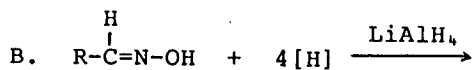
20. The product obtained when acetic acid is treated with thionyl chloride is



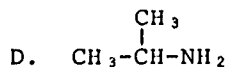
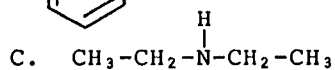
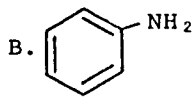
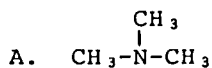
21. The reaction between aniline and nitrous acid at low temperature yields

- A. a N-nitroso amine
- B. a diazonium salt
- C. a nitrile
- D. an amine nitrite salt
- E. none of the above

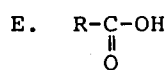
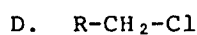
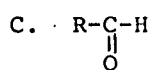
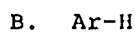
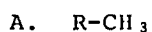
22. Which reaction DOES NOT yield an amine?



23. Which amine forms a sulfonamide that is insoluble in an alkaline solution?

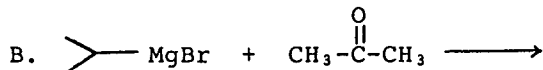
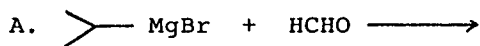


24. In the nmr spectrum, the farthest downfield shift will be exhibited by the proton or protons in which compound?



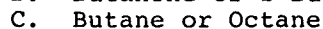
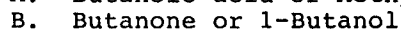
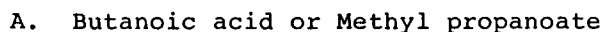
II. 簡答題

25. What are the products of the following reactions? (2%)

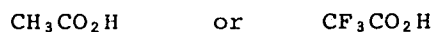


26. Determine the empirical formula of an organic compound whose percentage composition determined by combustion analysis is: 40.01% carbon, 6.11% hydrogen. If the molecular mass of the compound is 180, what is the molecular formula? (4%)

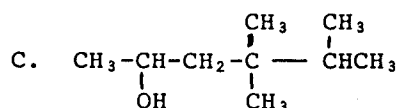
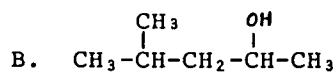
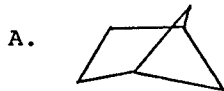
27. In the following pairs, which compound should have the higher boiling point? Why? (6%)

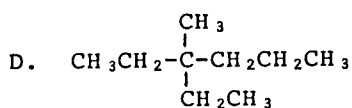


28. Which of the following has the higher pKa? Why? (2%)

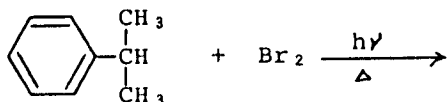


29. Name the following compounds: (use IUPAC name)

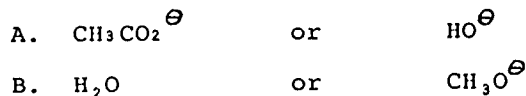




30. What is the major product of the following reaction? (2%)

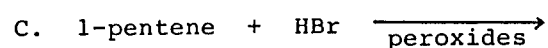
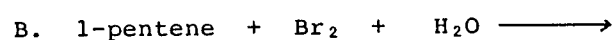
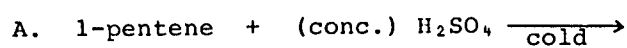


31. In the following pairs, which has the higher nucleophilicity? (2%)

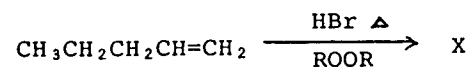


32. What are the structures of three products that can result from putting t-butyl chloride in a mixture that is 80% methanol and 20% water? (6%)

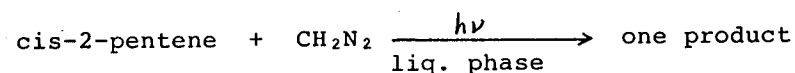
33. Draw structural formulas for the products of the following reactions: (6%)



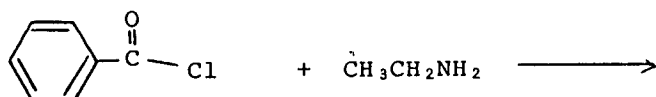
34. Draw the structure of the product X. (2%)



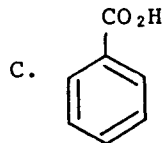
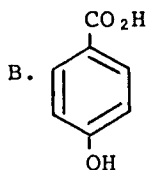
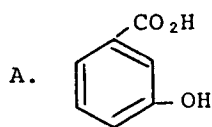
35. Show the product of the following reaction: (2%)



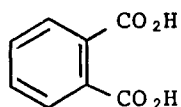
36. Draw the structure of the product(s). (2%)



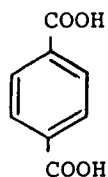
37. Arrange the following in order of decreasing acidity. (2%)



38. Which of the following has smaller pKa? Which would lose the second proton more easily? (2%) Why?



Phthalic acid



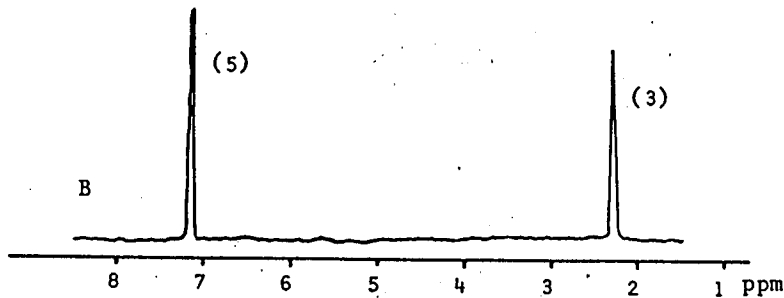
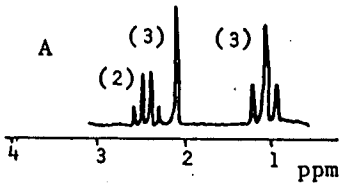
terephthalic acid

39. Draw the structure of the product. (2%)



40. In an effort to gain information on the active constituents in airplane glue, a student was able to determine that: (6%)

- Preparative vapor-phase chromatography provided two volatile components (A and B).
- An exact mass determination indicated $\text{C}_4\text{H}_8\text{O}$ as formula for A and C_7H_8 for B.
- The nmr spectra are shown below.



Give structures for A and B consistent with these data.