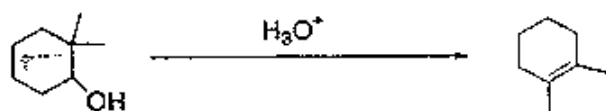


國立中央大學九十學年度碩士班研究生入學試題卷

所別: 化學學系 不分組 科目: 有機與無機化學 共 2 頁 第 1 頁

簡答題 (44%)

1. When 1,3-butadiene and HBr react at a low temperature (-80°C) in the absence of peroxides, the major reaction is 1,2 addition, but it is 1,4 addition at a higher temperature (40°C). In addition, when the mixture formed at the lower temperature is brought to the higher temperature, the relative amounts of the 1,2 vs 1,4 product change. The new mixture eventually contains the same proportion of products given by the reaction carried out at the higher temperature. Use a free-energy diagram to explain these observations. (5%)
2. Starting with *trans*-2-butene, how do you make the meso compound (2*R*,3*S*)-2,3-butanediol? (6%)
3. Give a reaction condition for 1-bromohexane where an E2 reaction dominates. The product should be provided. (5%)
4. Give an example for the the Diels-Alder reaction by using Maleic anhydride as one of the substrates. (5%)
5. Point out the relative peak positions of the carbonyl groups when we compare the IR and ^{13}C NMR spectra of benzaldehyde with those of benzamide. (6%)
6. Explain why amides are weaker bases than corresponding amines. (5%)
7. Propose a synthesis of hexanoic acid by using diethyl malonate and 1-bromobutane. (6%)
8. Propose a reasonable mechanism for the following reaction. (6%)



解釋名詞 (6%)

9. 1,3-diaxial interaction (2%)
10. solvolysis (2%)
11. tautomerizations (2%)

注意：背面有試題

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無機考題 (50%)

12. Construct the molecular orbitals of NH_3 using the atomic orbitals of N and H. Calculate the bond order between N and H from the molecular orbitals. (10 points)
13. How to construct a diode structure? Name two common applications of diode structure. (10 points)
14. The most common source of mercury is cinnabar (HgS), whereas Zn and Cd in the same group occur as sulfide, carbonate, silicate, and oxide. Why? (5 points)
15. When $\text{cis-OsO}_2\text{F}_4$ is dissolved in SbF_5 , the cation OsO_2F_3^+ is formed. The ^{19}F NMR spectrum of this cation shows two resonances, a doublet and a triplet having relative intensities of 2:1. What is the most likely structure of OsO_2F_3^+ ? What is its point group? (6 points)
16. Predict the products of the following reactions: (3 points each)
 - a. $\text{Mn}_2(\text{CO})_{10} + \text{Br}_2 \rightarrow$
 - b. $\text{HCCl}_3 + \text{excess } [\text{Co}(\text{CO})_4]^- \rightarrow$
 - c. $\text{Co}_2(\text{CO})_8 + (\text{SCN})_2 \rightarrow$
17. Which do you think would be the greater health hazard: the release of a radioactive nuclide of Sr or a radioactive nuclide of Xe into the environment? Assume the amount of radioactivity is the same in each case. Explain your answer on the basis of the chemical properties of Sr and Xe. Why are the chemical properties of a radioactive substance important in assessing its potential health hazards? (10 points)