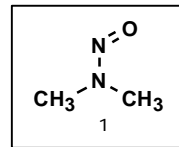


# ORGANIC CUMULATIVE EXAMINATION

November 6, 1999

Name \_\_\_\_\_

1. The hydrogens of dimethylnitrosamine, **1**, exchange completely with the D of D<sub>2</sub>O when it is heated for several hours with NaOD/D<sub>2</sub>O. When the same experimental conditions are applied to diethylnitrosamine, it is found that only the methylene H exchange.

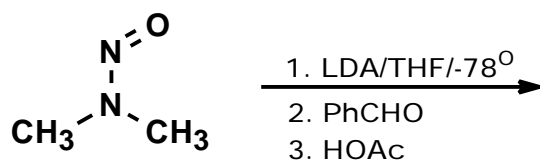


a. (7) Write a mechanism for the H/D exchange of **1**.

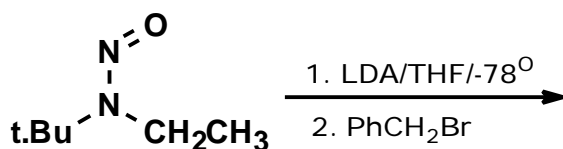
- b. (3) These observations suggest a commonality between the NNO group and what common organic functional group?

2. (12) Predict the products of each of the following transformations.

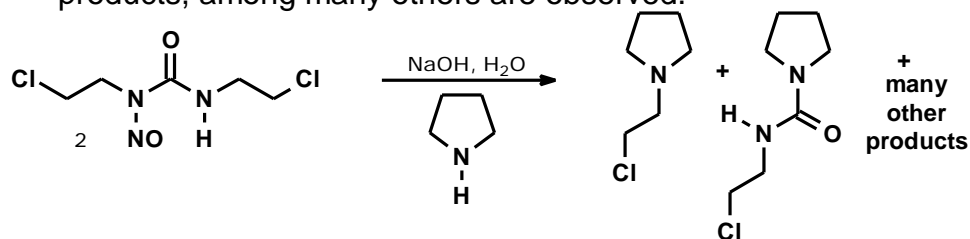
a.



b.

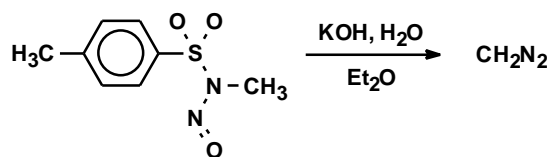


3. (15) The nitrosourea BCNU, **2**, is highly toxic, clinically used, anticancer agent. When it is reacted in the laboratory with a 0.5 M solution of NaOH containing 1M pyrrolidine, the following products, among many others are observed.



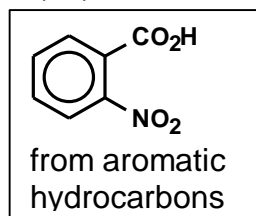
Write a mechanism for this transformation which explains the formation of these products.

4. (10) Diazomethane is often produced in the lab by the reaction shown below. Give a plausible mechanism for its formation.

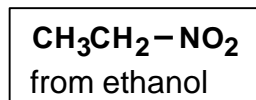


5. Outline an efficient synthesis of each of the following compounds from the materials indicated and any other necessary reagents.

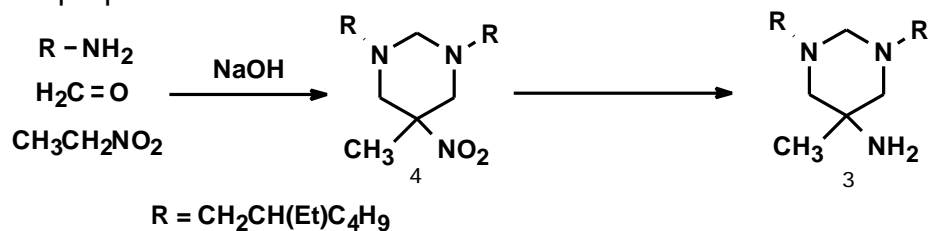
a. (10)



b. (7)



6. Hexetidine **3** is a commercial antibacterial agent. A key intermediate **4** in its synthesis is prepared as shown.



a. (15) Provide a mechanistic rationale which explains this transformation.

- b. (3) What reagents would you utilize to accomplish the conversion of **4** to **3**?
7. (6) Nitro compounds have been known for years to be explosive. Give the structure of two common such compounds.
8. (12) Dimethylnitrosamine **1**, like many other alkyl nitrosamines, is a potent carcinogen in many animal species. It is known that methyl groups **1** are found attached to various oxygen and nitrogen atoms in DNA. Other research supports the hypothesis that the carcinogenic activation of **1** involves its enzymatic  $\alpha$ -hydroxylation to give the unstable compound **5**. Give a mechanism for the decomposition of **5** which explains the methylation of DNA by **1** under biological conditions.

