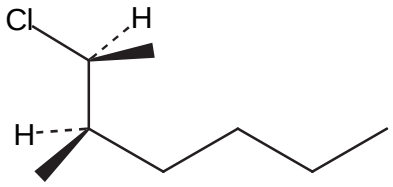
Chemistry 125 Third Examination Name _____
November 14, 2003

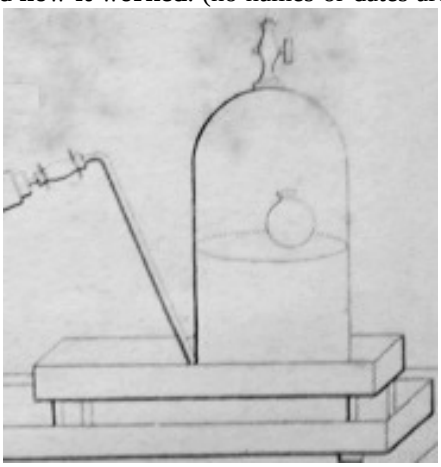
1 . (6 minutes) **A.** Give the **complete** systematic name of this compound :

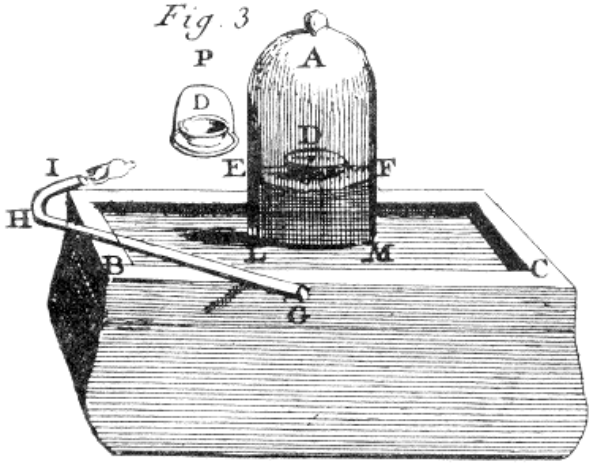


B . Draw the compound's **enantiomer**

C . Draw the compound's **diastereoisomer**

2. (6 min) Choose one **(ONE ONLY)** of the following two pieces of apparatus and explain briefly **what it was used for** and **how it worked**. (no names or dates are necessary)





3 . (12.5 min) For over two centuries tartaric acid, HOOCCH(OH)-CH(OH)COOH, and its relatives have repeatedly played important roles in the development of **experiment, theory, and nomenclature** in organic chemistry.

Briefly describe 5 (**FIVE ONLY**) of these developments. Mentioning specific experiments/theories/notation is most important - modest additional credit will be given for dates and chemist's names,

[HINT: some relevant dates are 1769, 1789, 1830, 1848, 1874, 1891, 1949]

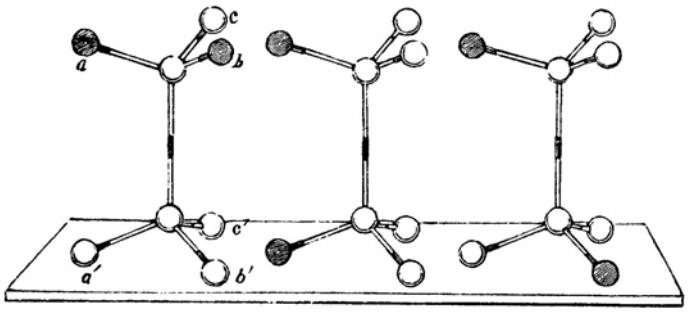
4. (6 minutes) Halogen substitution of Arppe's nitroaniline, $C_6H_4(NH_2)(NO_2)$, a "relative" of "hydroxybenzoic acid", played a key role in Koerner's proof of the equivalence of the positions of hydrogen atoms in benzene,

A. Explain schematically how the halogen substitution experiments contributed to the logic of Koerner's proof. (**Don't** worry about the nitty-gritty mechanism of the actual reactions in HOMO/LUMO terms)

B. Why was it important that Arppe's nitroaniline was shown to be a relative of hydroxybenzoic acid?

5. (4.5 min) In 1869 Paternó published this figure.

A. What experimental observation(s) was Paternó trying to explain?

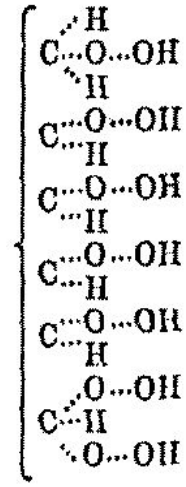


B. Lieben then cautioned Paternó that "Shooting off into space one risks losing the ground under his feet" He specifically mentioned a supposed conflict between Paternó's model and the facts about dichloromethane. Explain.

6. (5 minutes) In 1838 Dumas discovered that reaction of acetic acid with elemental chlorine in the sunlight generated successively, mono-, di-, and trichloroacetic acids. Explain the implications of this observation for the two theories of organic chemistry that were current at that time.

7. (10 minutes) Carbohydrates are so called because they have the formula $\mathbf{(C{\bullet}H_2O)_n}$

A. S. Couper published the formula shown on the right for glucose, a very common carbohydrate.



A . What are the **two main concepts** that Couper introduced in the paper that contains this formula?

B . The "carbohydrate" formula should be $C_6H_{12}O_6$, but Couper's formula shows $C_6H_{14}O_{14}$. Explain how we might still consider Couper's formula for glucose to be fundamentally correct.

C . Explain in HOMO/LUMO terms how there can be a reaction of water with the carbohydrate glucose to generate the molecule that Couper was drawing.