

Chemistry 125 Third Examination
November 12, 2004

Name _____

1. Water

A. (0.5 minutes) WHO invented the names "hydrogen" and "oxygen"? _____

B. (0.5 min) WHO invented their symbols "H" and "O"? _____

C. (2 min) What does the word "oxygen" mean?

D. (2 min) Why did Dalton think water was HO?

E. (2 min) Why did Gay-Lussac think water was H₂O?

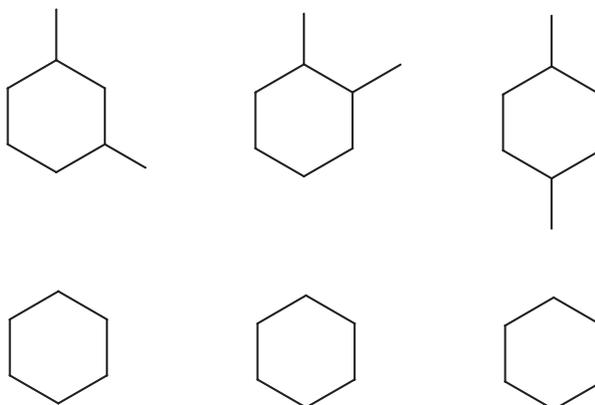
2. (6 minutes) The four forms of the diacid HOOCCH(OH)CH(OH)COOH have the following properties. Under each set of properties draw Fischer projection(s) to show the configuration of the corresponding molecules. If you are uncertain, explain your uncertainty briefly.

| | | | | |
|-------------------|-------|-------|-------|-------|
| m.p. | 140°C | 170°C | 170°C | 206°C |
| $[\alpha]_{20}^D$ | 0 | +13 | -13 | 0 |

3. (2 min) Explain briefly how elemental mercury played an important part in the experimental work of Lavoisier.

4. In 1866 August Kekulé suggested that his hexagonal structure for benzene was consistent with the existence of three isomers for disubstituted benzenes, but it was his former coworkers who tested this hypothesis with rigorous logic.

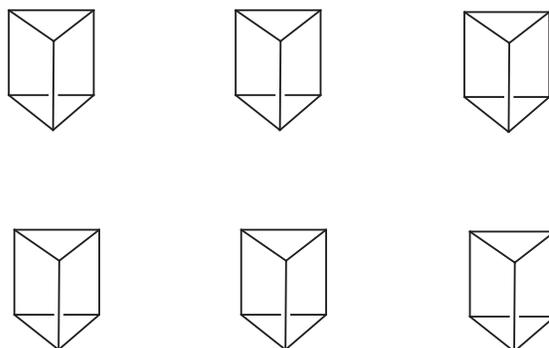
A. (3 min) Wilhelm Koerner showed how to demonstrate **which of the three isomers** in the first line below **was which** on the basis of chemical transformations. Complete the diagram to **illustrate this proof**. (No words necessary)



B. (3 minutes) Albert Ladenburg, a contemporary of Koerner in Kekulé's laboratory, preferred the prism structure, shown below, for benzene.

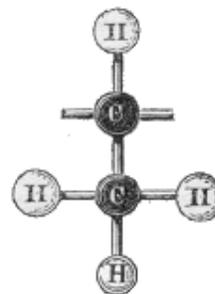
What was Ladenburg's main objection to Kekulé's hexagon structure?

C. (5 minutes) Complete the diagrams below to **show Ladenburg's disubstituted isomers of prismane** **AND** to suggest a **Koerner-style proof of which isomer is which**. (No words necessary)



D. (4 minutes) In 1876 J. H. van't Hoff, a third student of Kekulé, criticised Ladenburg's prism structure. Explain briefly **how this criticism related to other work** that van't Hoff was involved in at this time.

5. (5 min) **Choose ONE** of the following figures, and tell how its creator meant it to explain **experimental observations**



6. (3 min) In the opinion of Couper **what two properties of the carbon atom** “explain all that is characteristic of organic chemistry.”
7. (4 min) **Explain why** we have **two** names, butyl bromide and bromobutane, to describe the same compound and why one name has a **space**, but not the other.

- 8.** (8 min) Use **curved arrows** to show the mechanism of **EITHER an addition OR a substitution** reaction involving Cl_2 .

X. EXTRA CREDIT (ONE POINT ONLY – DON'T WASTE TIME UNLESS YOU HAVE PLENTY TO SPARE

Describe what you consider to be the most egregious example of lack of imagination by an important 19th Century organic chemist.