



**RUTGERS**  
UNIVERSITY

Department of Materials Science and Engineering

**Glass Engineering -- 150:312**  
**Hourly #2**

**Spring Term 2007**  
**Time Limit: 80 minutes**

**Prof. Lehman**  
**Thursday April 12, 2007**

**Name** \_\_\_\_\_

1. What elements are used to produce the following colors in glass. In each case, note if the coloring is achieved by solution or colloidal mechanisms.
  - Deep blue
  - Aqua
  - Green
  - Red
2. Diagram the material flow through a batch house, identifying the various unit operations (steps) and processes.

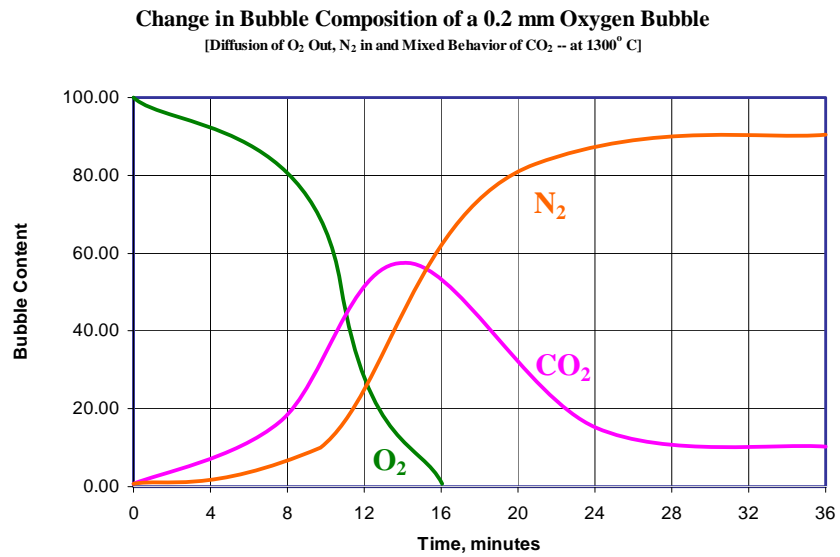
3. What is the relationship by which redox number is calculated? The salt cake to carbon mass ratio is 23.7. How is this value obtained?

4. What is Oxy-fuel firing? What are its benefits?

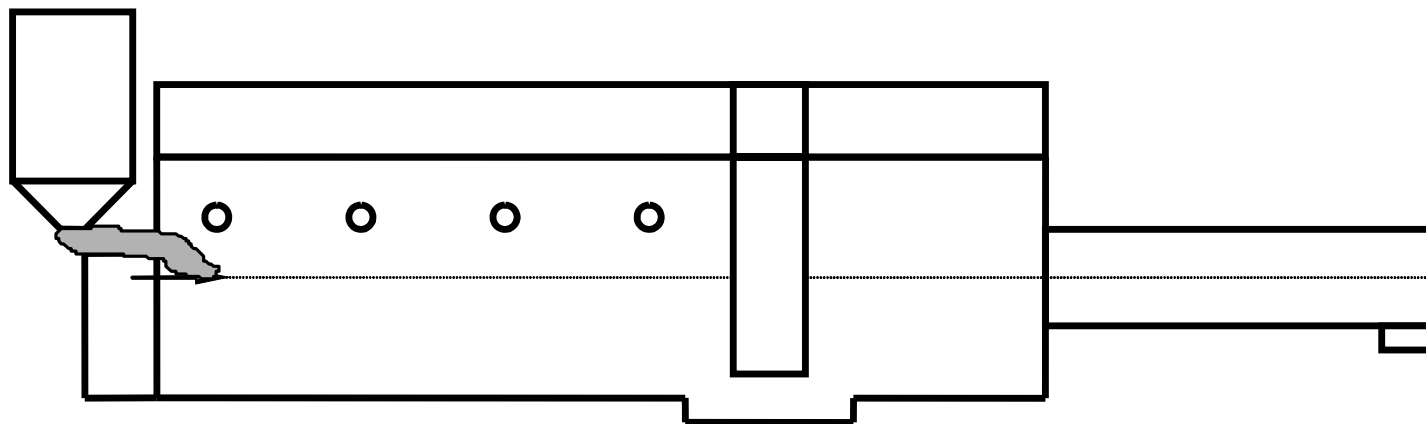
5. Cold top electric melting has the advantage of recycling condensable vapors. Give two examples of glasses that contain such vapors and explain (using a diagram) how such vapors collected and returned to the process.

6. Glass melting is a heat transfer limited process. How do batch piles contribute to this bottleneck? What can be done to help?

7. Gas solubility in glass is a dynamic process. Explain what's going on in the following graph. That is, when a pure oxygen bubble is inserted into the glass at time=0, why do the  $O_2$ ,  $CO_2$ , and  $N_2$  partial pressures change as shown.



8. On the furnace profile diagram below, label the bulleted items noted.



- Batch surge hopper
- Crown
- Doghouse
- Feeder
- Forehearth
- Glass convection cells (2)
- Glass level
- Melter zone
- Refiner zone
- Throat