

**Chemical Engineering 201**  
**Fall 2001**  
**Final Exam**

Name \_\_\_\_\_

Problem # 1 \_\_\_\_\_

Problem # 2 \_\_\_\_\_

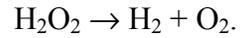
Problem # 3 \_\_\_\_\_

Bonus Problem \_\_\_\_\_

Total (300 possible) \_\_\_\_\_

Problem One (100 points):

Hydrogen peroxide can undergo a unimolecular decomposition reaction with the following stoichiometry:



100 moles of pure hydrogen peroxide is sealed in a rigid glass vessel and the reaction is initiated with ultraviolet light. The reaction is allowed to continue at constant temperature until it stops. A closed ended manometer with mercury as the manometer fluid is attached to the glass vessel and shows that the height on the manometer has increased to 998 mm. The original height on the manometer was 760 mm, meaning the the pressure inside the vessel was equal to the pressure outside the vessel, which was 1 atm. What is the fractional conversion of hydrogen peroxide?

Problem Two (100 points):

15 gallons/hr of ethanol are burned in 100 percent excess air. The ethanol and air enter the burner at 25°C and 1 atm. The product gases, which contain no carbon monoxide, are discharged to the atmosphere at 400°C. If only half of the ethanol reacts, how much heat must be added to or removed from the reactor?

Problem Three: (100 points)

10,000 Liters per hour of air are taken into an air conditioning system to cool a large building. The entering air is at  $40^{\circ}\text{C}$  and has a relative humidity of 20 percent. What is the dew point of the entering air? How much water (in milliliters) is condensed out from the air if the final temperature of the exiting air is  $10^{\circ}\text{C}$ ?

**Bonus Problem** (30 extra points if completely correct. **No credit without the correct answer!**):

Yet again, 200 moles of pentane are burned with 200 percent excess air. If only half of the pentane reacts, how much air was fed to the burner? (Please get this right this time!)