

# Engineering Project • Hot Air Balloon

## Chemistry 192

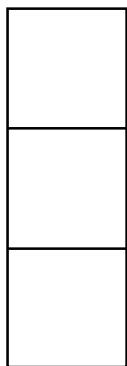
### The Assignment:

As a summer intern with an engineering firm, you have been asked to create a design for a small hot air balloon and to build a prototype balloon. Your supervisor provides you with a few guidelines and parameters, but leaves most of the work up to you.

### Guidelines and Parameters:

- **Materials:** Tissue Paper, Glue, Scissors, Masking Tape, Paper Clips, Decorations.
- **Basic Design:** One possible design follows. The balloon would be made of panels of tissue paper. Each panel would consist of three sheets of tissue paper glued together as in *Figure 1* below. You will want to cut the panels to the approximate shape in *Figure 2*. All panels should be identical in shape and size. The top of the balloon should be closed. The bottom of the balloon should be open to allow the balloon to fit over the hot air source. The exact dimensions of each panel and number of panels will be left up to you. ***Other, more creative designs can result in higher design grades.***

*Figure 1.*



*Figure 2.*



- **Parameters:** It is recommended that the balloon be 1.25- 2.0 meters in height when *inflated* (minimum accepted is 1m *inflated*). Panel width is up to you, but you will be limited by the width of the tissue paper or other material you use. The bottom opening should be approximately 30-35 cm in diameter.
- **Decoration:** The balloon should be highly decorative and individual. Use your imagination. You can buy colorful tissue paper, use markers, crayons, etc. ***Be creative!***

# Evaluation and Assessment

## 1) Project Progress Report *Due:* \_\_\_\_\_

- A) Diagram of the balloon specifications.
- B) All materials that will be needed.
- C) Progress that has been made in assembling the balloon.
- D) Your work plan for finishing the balloon.

## 2) Completed Hot Air Balloon *Due:* \_\_\_\_\_

- A) Meets parameters.
- B) Construction (Quality of Craft)
- C) Creativity - Decoration
- D) Functionality (Does it fly? How well?)

## 3) Balloon Design Poster *Due:* \_\_\_\_\_

This should illustrate design features of your balloon, as well as a thorough explanation of how a hot air balloon flies. Specific information the poster should include follows:

- A) **Diagram:** A scaled, schematic diagram of completed balloon - both of a panel and the full balloon, with specifications (measurements) indicated.
- B) **Assembly:** A description of the materials used and the process of assembly.
- C) **Calculations:**
  - 1) Calculated estimate of the **volume** of air inside the balloon.
  - 2) Calculation of the **number of moles** gas inside the balloon at 85°C.
  - 3) Calculation of the **mass** of the gas inside the balloon at 85°C.  
(Assume the composition of air is 80% *by mole* N<sub>2</sub> and 20% *by mole* O<sub>2</sub>.)
  - 4) Calculation of the **overall density** of the balloon.  
(Consider mass of the balloon itself and the air inside!)
  - 5) Calculate the **density of air** (80% by mole N<sub>2</sub> and 20% by mole O<sub>2</sub>) at 20 °C.
- D) **Poster Layout and Design:** Poster should be professional, colorful, and communicate your understanding of the project assignment.
- E) **Theory:** Provide a qualitative description (diagrams would help) explaining how a hot air balloon can fly.