LESSON PLAN

Designing a Hairdryer

Title	Designing a Hairdryer
Course	Thermodynamics I
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Time duration	In-class activity, 90 minutes
Overview	This activity is designed to explore how the design process can be influenced by the diversity within a team. Hairdryers are fairly simple products that Thermodynamics students should reasonably be able design a few weeks into the course. Through the design of a hairdryer, this activity explores how we make design decisions based on our own experiences and assumptions. Different hairdryer attributes, such as heat settings or speed, may be preferred for different types of hair. Without some diversity or exposure to different experiences with the product, the team's creativity and design options may be limited.
Objective	• Develop awareness of the assumptions we make when engaging in a design process • Develop empathy for the various needs of end users of our products • Explore methods for gaining insight into different perspectives during the design process
Materials	Handout (attached)
Procedures	Students work in small groups of 3-4 to complete the design activity and collectively fill out an activity handout. Upon completion of the activity, the entire class is involved in a discussion to share their designs and debrief the process. A follow up reflection piece asks students to articulate the lessons learned through this activity.
Activity Debrief/Discussion	After the activity, students engage in a discussion about the design process and implications about the composition of the design team. The instructor probes for issues related diversity and inclusion within the design group.

Potential In-class Debrief Questions:

- What was the most difficult part of the design?
- What design considerations did you take into account?
- How did your prior experience with the product reflect how you looked at the design?
- What specific population(s) did you consider for your design? What populations did not you not consider in your design? Why or why not?
- Did the makeup of your team affect how you looked at the design?
- Looking at other teams' design ideas, did your group not consider something that maybe you should have? Did this have to do with the makeup of your team?
- Were you able to find information (via Google, books, etc.) that helped you if you didn't know something about your product?
- What could you have done during the design process to create a product that would fit the needs of different populations?

Post-activity reflection

After the activity, students individually fill out a reflection piece, to be submitted one week following the activity.

Potential reflection questions:

- What assumptions did your design team make in this design process? What did you neglect to consider?
- How would having a diverse design team help during this type of process?
- Why would having a diverse design team be important for **all** projects?
- Will what you learned from this activity affect the way you work in teams for future engineering projects? Explain why or why not.
- What did you learn from this assignment?
- What did you like about this assignment?
- What would you suggest to improve this assignment?

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HANDOUT

Thermodynamics I - In Class Activity

Designing a Hairdryer

BACKGROUND: A hairdryer is an interesting example of thermodynamic design. It combines energy conversion, heat transfer, and fluid mechanics in one device. The goal of this exercise is to consider different design aspects of a hairdryer and how they are related to thermodynamic applications (or not!).

METHODS: You will be placed into groups of 3-4 people. In these groups please discuss and answer the following questions. You are welcome to use outside sources to help answer your questions (books, Google, etc.), however you are responsible for citing your sources and vetting the information! One document will need to be turned in per group and you may fill in your answers by hand on this sheet.

GROUP MEMBERS:

_____

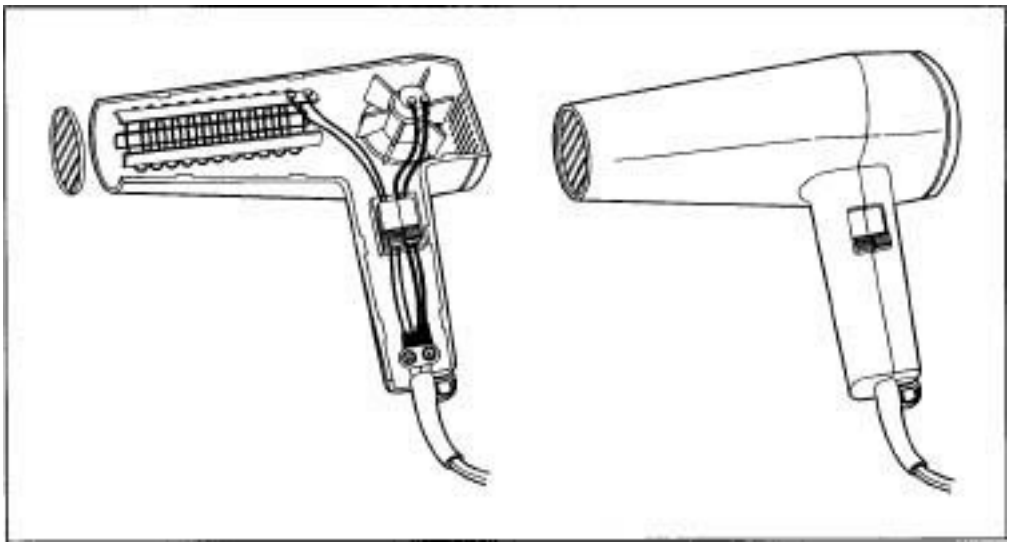
_____

QUESTION #1:

How does a hairdryer work?

QUESTION #2:

Label the relevant parts of the following image:



QUESTION #3:

The fan pulls quiescent air from the outside and moves it through the front nozzle. If there is 1 kg/s of air brought in and the air moves at a rate of 10 m/s through the nozzle, how much energy is required to run the fan?

QUESTION #4:

If you wanted to increase the speed of the air exiting the hairdryer, how would you change the design? Think of more than one option! Also, how fast is too fast?

QUESTION #5:

The heating element warms the air from 22°C to 50°C before it exits the nozzle. If the air still goes from 0 to 10 m/s, how much energy is required for this temperature change?

QUESTION #6:

What range of temperatures should the hairdryer provide? Why? How would you design the hairdryer to accomplish this?

QUESTION #7:

What other attributes do you think a hairdryer needs? How could you “improve” the current hairdryer design? Have fun and be creative!