Beats by ME–Headphone Engineering

Project Due Date: _____

Recently the consumer market for headphones has exploded with the success of celebrity-endorsed products such as Dr. Dre's Beats and Lady GaGa's Monster earbuds. Headphones have gone from a relatively bland commodity product to a highly personalized object of self-expression. What you wear on your head serves not only to bring sound to one's ears, but also signals to the rest of the world something about your personal values. Your choice in music and musical artists says something about you to the world – your values, what you think is "cool." You wish to start your own headphone company, but in order to get funding (access to materials), you must convince an investor that your company will be successful.

1. Headphone Design

Design your headphones with any school appropriate theme, *as long as it meets these minimum criteria*:

- Your headphones must have *two speakers* that are connected to each other and can be worn on a user's head
- Your headphones must have the audio plug attached, or easily connect to one using alligator clips

2. Approval of Elevator Pitch & Prototype

First, you must build a working prototype of a speaker. It is required that you try 3 different designs (by changing materials, geometries, or construction methods) and document which designs work best, using pictures, sketches, and/or descriptions.

Second, you must give a 30-second "elevator pitch" that convinces a venture capital firm to invest in your startup company. You must convince the venture capitalist (your teacher) that you:

- understand the physics behind headphones
- have designs for headphones that will appeal to a certain demographic and be commercially successful
- are capable of actually producing your planned headphones

When your elevator pitch is presented to the venture capitalist along with your prototype, it will either be **funded or denied**. If it is denied, meaning your elevator pitch was not convincing, you must **re-pitch** *in order to be funded with materials*. The venture capitalist firm will use the following form to fund or deny your company:

The speaker prototype is audible. The elevator pitch convinces the venture capital firm that you understand the physics, are capable of bringing your product to market, and that it will be commercially successful. (10 pts)		
Date pitched:	□ Denied	□ Funded
Re-pitched on:	□ Denied	□ Funded

3. Construction Phase

Upon the funding of your startup company by the venture capitalist (your teacher), you may begin the actual construction of your headphones. Structural materials can include, but are not limited to: cups, cans, small boxes, etc. There will be a few open build workshops after school if you need help. Here are the key points:

- Your headphones will be constructed from recycled magnets, wire, and other recycled materials
- You can earn extra credit by designing stereo headphones (sound can be sent to left and right ear independently)
- You will need access to hot glue, scissors, wire cutters, and other school supplies
- You may **not** use any part that is taken directly from commercially-produced headphones (ex. you can't rip the headband off a set of old headphones to use in your own)

4. Headphone Audio Performance

You want your headphones to sounds great, so it's important that you carry out tests to determine the overall audio quality. The sound of your headphones will be evaluated using the benchmark tests on this site: http://www.audiocheck.net/soundtests_headphones.php, so it is advisable that you test your headphones using the same audio test files. (You may want to download these files onto a phone or MP3 player, if possible. Your teacher will also have a way for you to test in class.)

The following rubric will be used to evaluate the sound of your headphones:

Test	**10 pts**	**8 pts**	**6 pts**	**4 pts**	**2 pts**
Low frequency response	40 Hz or lower	80 Hz	120 Hz	160 Hz	200 Hz or higher
High frequency response	18 kHz or higher	14 kHz	10 kHz	6 kHz	2 kHz or lower
Dynamic range	30 dB below full scale or greater	24 dBFS	18 dBFS	12 dBFS	6 dBFS or less
Quality	No buzzing/ rattling at any audible frequency	Slight buzzing/ rattling	Moderate buzzing/rattling	Pronounced buzzing/rattling	Severe buzzing/rattling
Driver Matching	Sound is centered in middle of head	Slight sound deviation	Moderate sound deviation	Pronounced sound deviation	Severe sound deviation

5. Design Evaluation

In order to determine the design appeal of your headphones, the investors will use this rubric for evaluation:

Area evaluated:	**Description**		
Durability	Headphones are well-built and will withstand everyday use (10 pts)	Headphones lack durability, feel cheap or flimsy to the user (5 pts)	Headphones are extremely fragile and likely to break within first few uses (0 pts)
Style	The style is unique and can be marketed to a particular demographic/age group (10)	The headphones are bland and may be a tough sell. (5)	The headphones do not appear desirable. (0)
Comfort	User is comfortable wearing headphones for long periods of time (over 1 hour of use) (10)	User experiences moderate discomfort wearing headphones (5)	User is extremely uncomfortable wearing headphones (0)
Design Brief	Includes all explanation of how speakers work (the physics), 3 pictures or sketches of prototypes, and an justification of choices for materials, construction, etc. (10)	Some explanation of how speakers work is missing or incorrect. Some missing documentation of prototyping process. Some missing justification of design decisions. (5)	Most information about how speakers work is missing or incorrect. Most documentation of design process is missing. No justification of design decisions. (0)

Final Point Value (score):

Elevator pitch & prototype completed: _____/**10 points**
Audio performance score: _____/ **50 points**
Design Evaluation score: _____/ **40 points**
TOTAL value: ____ /100 points