

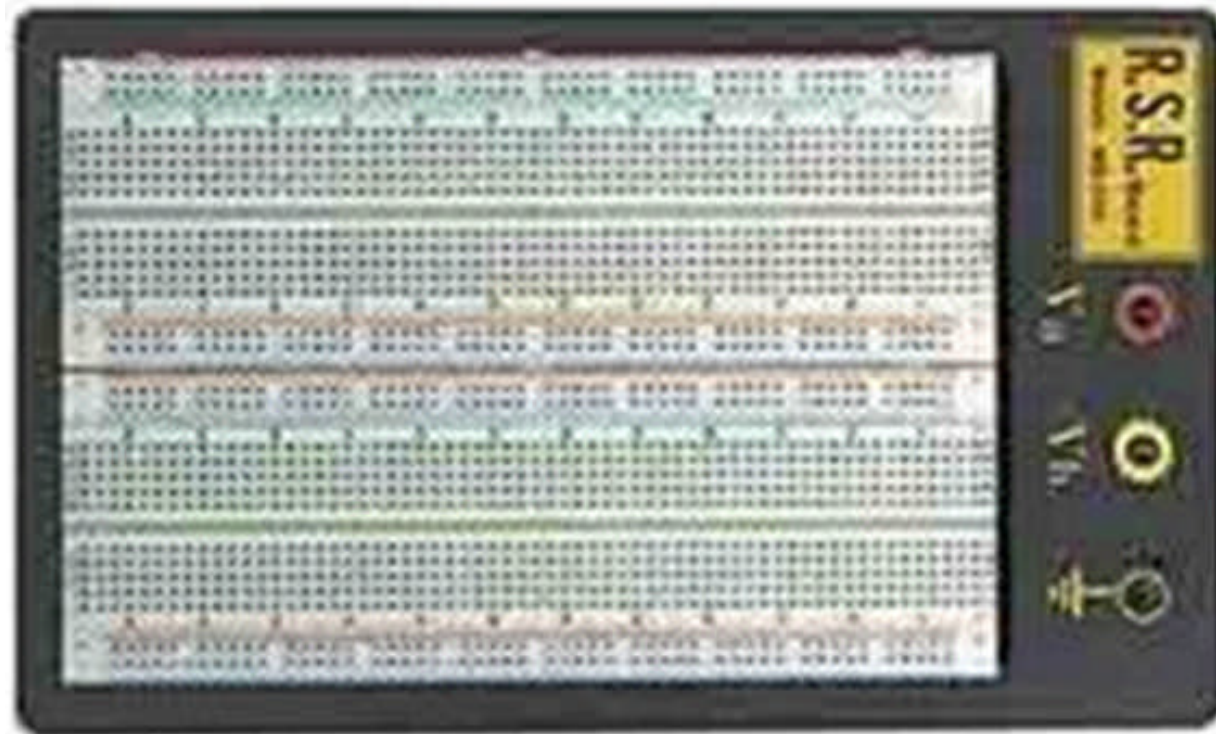
16.312

Electronics Lab.

Experiments

2 weeks lab.

Solderless Prototyping Board
top half for **Audio input**
bottom half for **Active Noise Cancellation**
jacks for **power connections**



Device Under Test

Audio Headphones

- - - **Active Noise Cancellation** - - - -

- Using standard op-amp Analog Devices AD712 ICs create a pair of noise canceling headphones.

Problem

- You just started at a small unknown audio design company in Boston that builds high-end speakers for home theaters.
- They want to get into the **Noise Cancellation Headphone** market.
- You are part of a team selected to make this happen, if this task is completed successfully there is possibility for a large pay bonus and a position in the R&D Engineering Dept.

Possible solution

- You and a selected team member will design and test a Active Noise Cancellation Headphones set on a product the company now sells to the PC gaming market.
- A test stand will also have to be built to test your design and prove that attenuation of low frequency ambient noise is successfully observed.

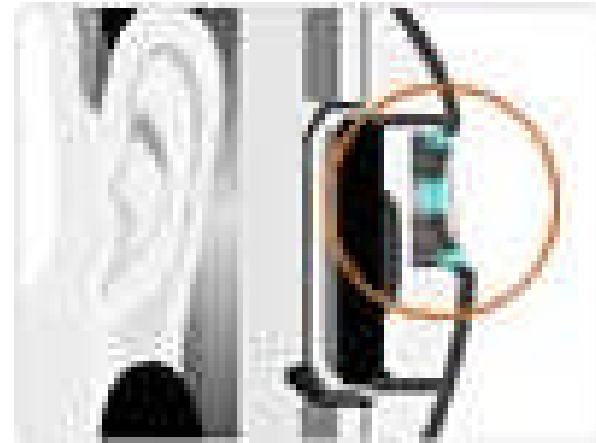
The DAY of DESIGN

- Teams will be two person. One member will have the right ear and the other will have the left ear, the side that gets the best noise reduction will get bonus points.
- Both sides will have to work before either team member gets credit for the lab.

Supplied Components

- AD712 op-amp's
- Trim pots for gain control
- Microphones (4each)
- Resistors (free stock)
- Capacitors (free stock)
- 24 awg. solid wire from cat-5 cable
- Shielded cable from stockroom
- Stereo Headphones with plug and jack

Bose Headphones = \$350



QuietComfort[®] 3 headphones

Company's Product

(\$6.95)



Test Fixture Model



HP 3582A

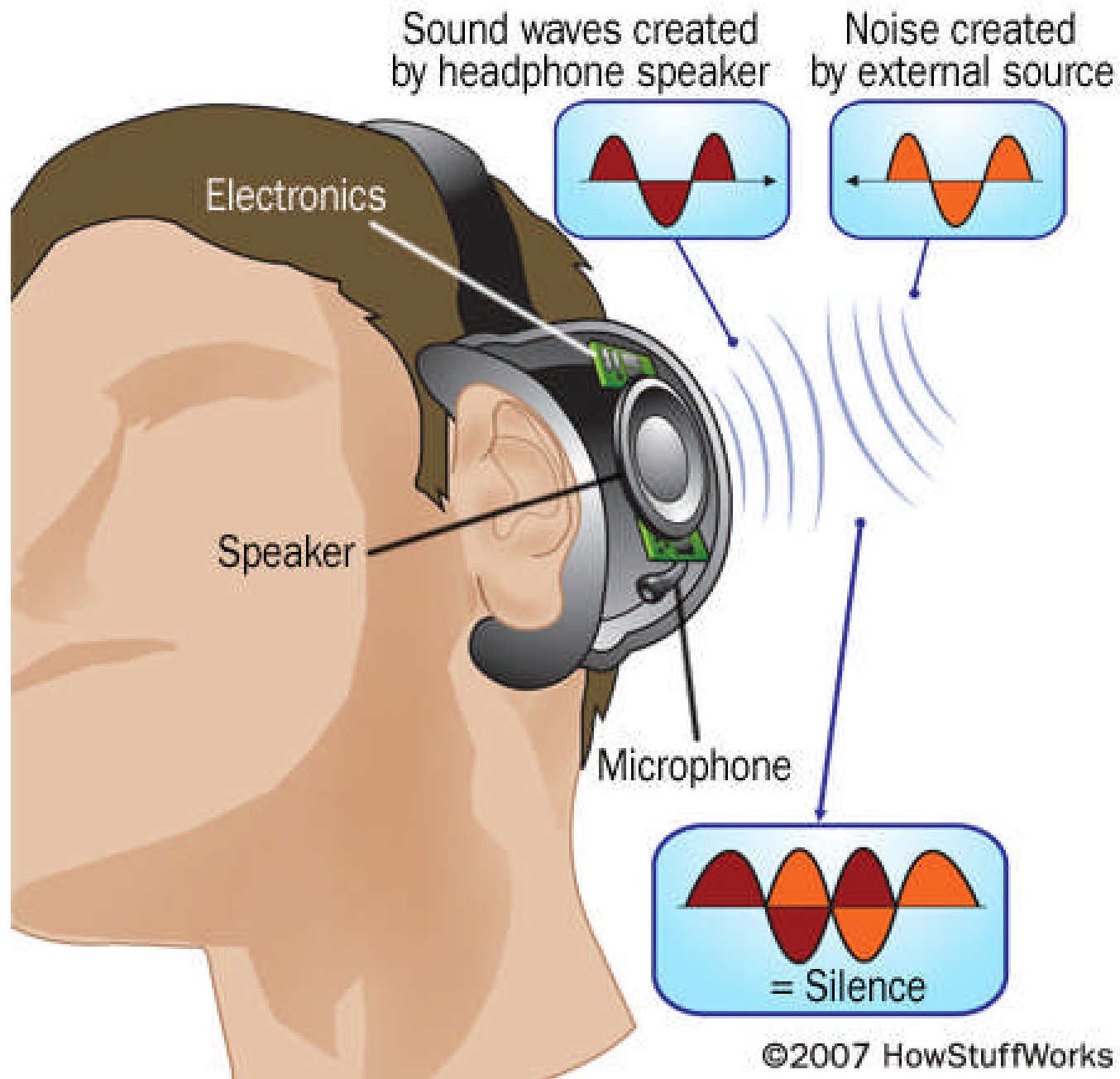
0 to 25,000 Hz Spectrum Analyzer



Test Fixture Model

- One test fixture head will be given to each team
- Head will have to have L & R Microphones and amplifier with BNC jacks to be able to connect to oscilloscopes and analyzer for test measurements.
- All team members must have some part in the design and fab. of the test fixture to be able to use it.

Inside noise-canceling headphones



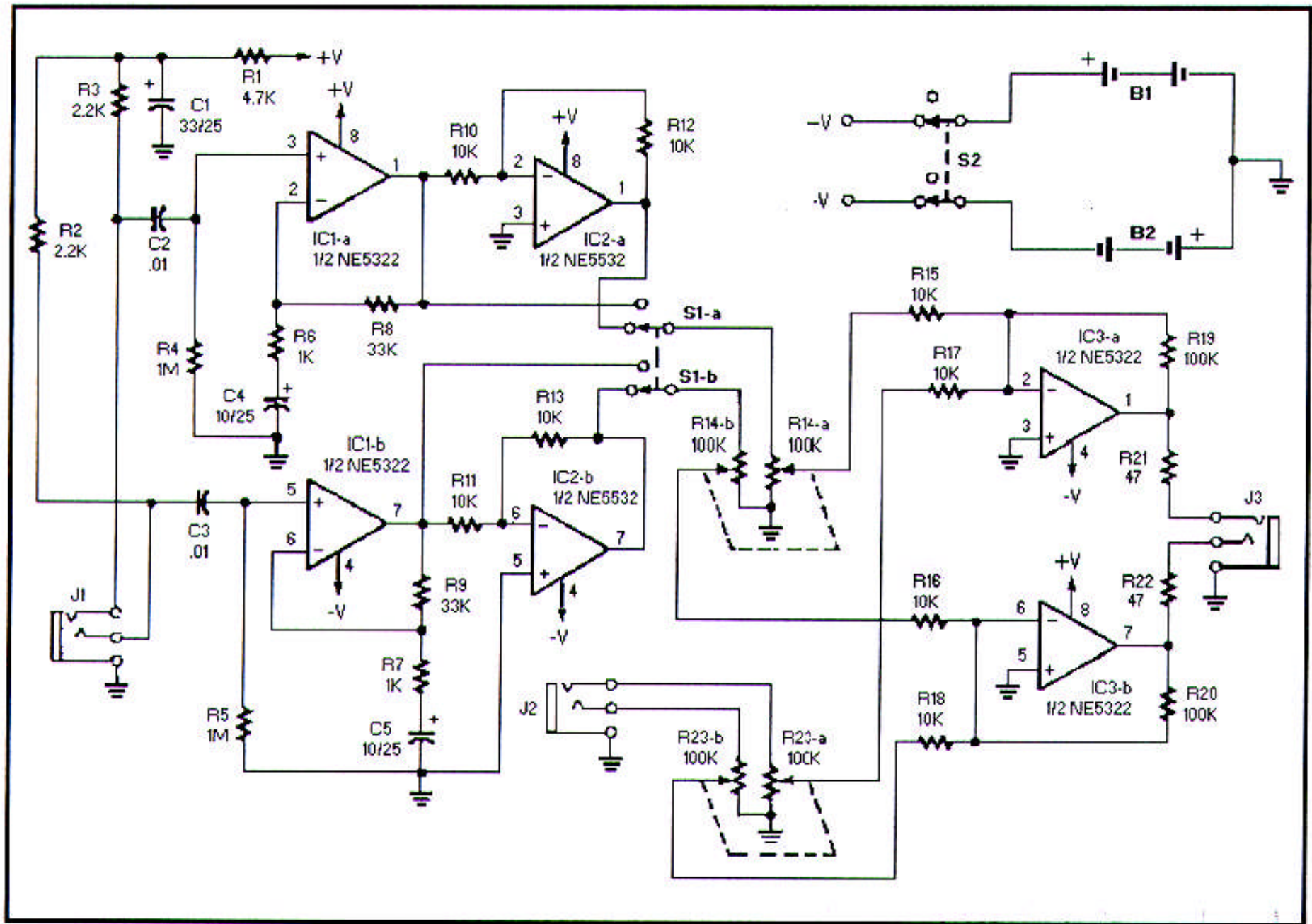
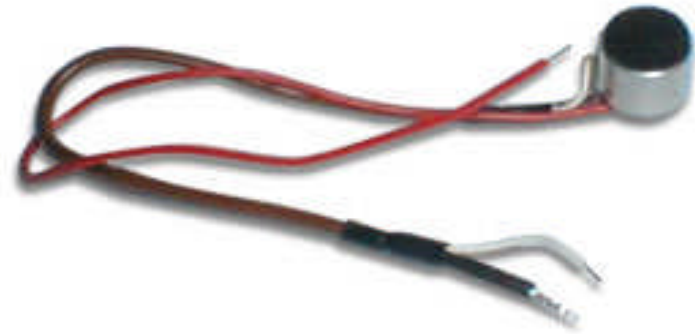
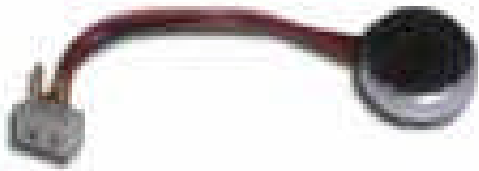
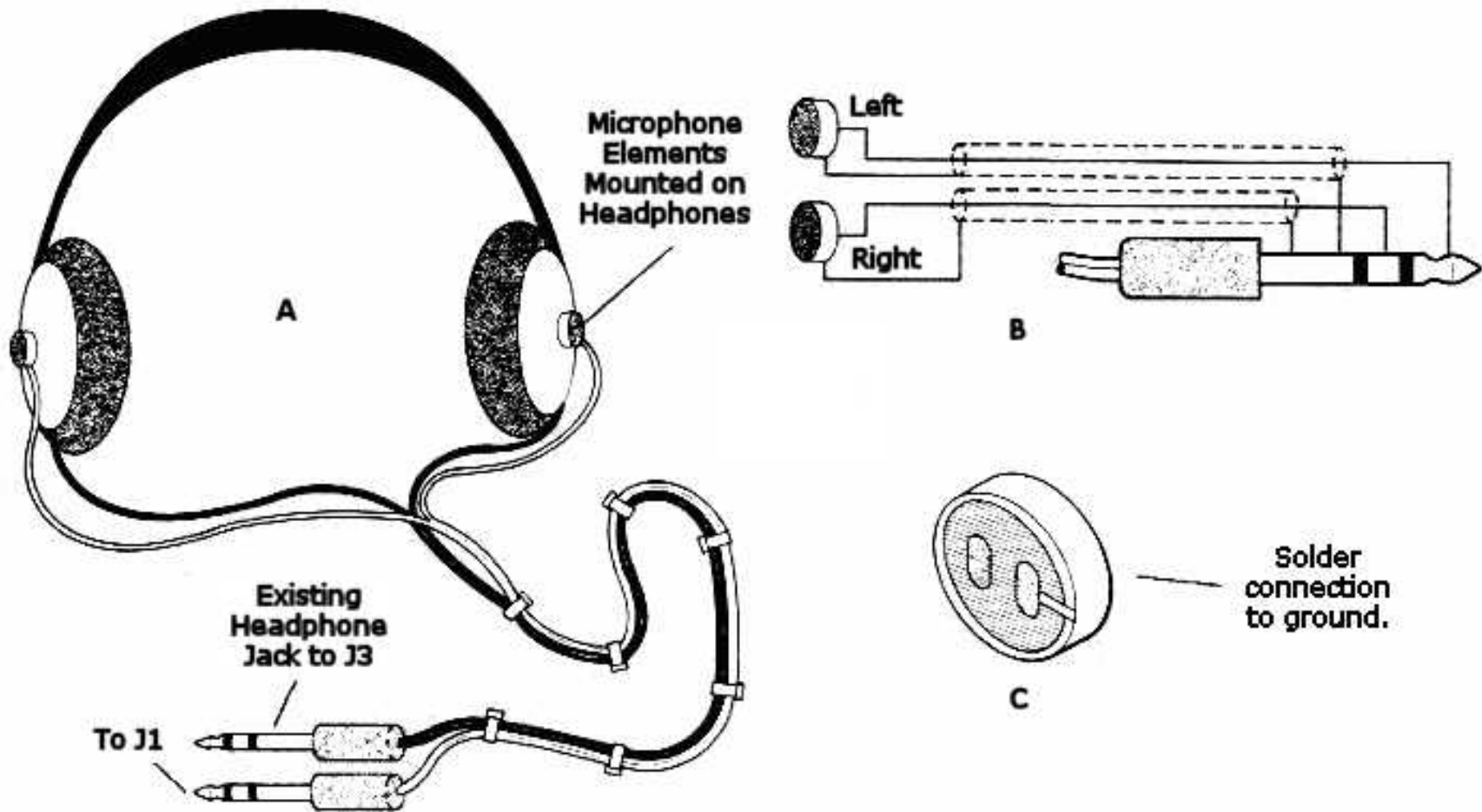


Figure 11: Complete Circuit Schematic

Microphones from stock



- Fig. The microphones are mounted on the earpieces of the headphones with a dab of HOT glue from glue gun. Tie both wires together in order to make the headphones more comfortable to wear (A). Follow the diagram in (B) when wiring the microphones. The left mic is connected to the plug's tip and the right is connected to the ring. The ground connection on an electret microphone cartridge is easily identified by the solder connection between the terminal and the mic's case (C).



Possible Design

- Pre-Amplifier
- Pre-Amplifier Active Noise
- Phase Inverter
- Summing Amplifier
- Output Amplifier
- Circuit is built in two parts Right and Left side

Notebooks

- Everything should be in your notebook and entered in real time. (not after leaving the Lab.)*
- Parts list with component cost
- Schematics / block diagrams/component layouts
- Test layout diagram
- Result conclusions
- Scope print-outs to back-up data & conclu.
- In ink !!!!!



30 points will be deducted if found with lab entry's on loose paper and not written in notebook

Grading

- Preparation before entering the lab (in the notebook) 30%
 - Schematic of the design
- Final design schematic 10%
- Parts list 5%
- Circuit description (how it works) 15%
- Neat circuit wiring on board 10%
- Scope pictures 10%
- Bench quiz 10%
- Clean up the work space 10%

Best Noise Reduction Team Award

(last year team winner -12dB)