FREQUENCY RESPONSE OF AN AUDIO AMPLIFIER AND LAB REPORT FORM

NAME: _____ **DATE**: _____

PARTNERS: _____

APPARATUS: Audio Amplifier, Oscilloscope, Resistive Load, Interconnecting Cables

A good high fidelity amplifier will have frequency specifications flat to within ± 1 dB from 20 Hz to 20 kHz at a specified power. Under the best conditions the human ear can barely detect a 1 dB change in sound level, and only a very young child can hear frequencies as high as 20 kHz. So an amplifier this good probably won't introduce any audible distortion of its own into your sound system. On the other hand, a 1 dB change in amplifier output voltage corresponds to about a 12% change in voltage which is easily measured with an oscilloscope. In this experiment you will study the response curve of an inexpensive audio amplifier and obtain a response curve. After you have found the response curve for your amplifier, you will use the sound level meter to record the frequency dependence of the sound produced by the system**.**

PROCEDURE

A. Connect the output of the signal generator to the audio system through its auxiliary input on the back and to the Channel B input on the oscilloscope. Attach the resistive load to the speaker output and to the Channel A input on the oscilloscope. Before turning on the apparatus have your instructor check your system

Suggested initial settings:

Amplifier volume very low.
Oscilloscope: Channel A: AC Coupling; Volts/division: 0.2 V/cm
Channel B: AC Coupling; Volts/division: 50 mV/cm
Sweep Time/cm: 1 ms/cm
Mode: Dual Channel A&B
Function Generator: 1 kHz; sine

Set the function generator output level to give 100 mV on Channel B on the oscilloscope. Check that this output level remains at a constant 100 mV as you adjust the function generator frequency from 20 Hz to 20 kHz. If it does not remain constant within, say, 5 mV, you will have to readjust the level at each frequency where you take data.

B. Usually manufacturers give the frequency response of an amplifier in dB relative to its response at a particular frequency. Use 1 kHz as the reference frequency. Adjust the generator frequency to 1 kHz and check that the input level to Channel B is still 100 mV. Watch Channel A which displays the amplifier output voltage and **slowly increase** the amplifier volume until the output level reaches 0.4 V.

C. Measure the amplifier output voltage at each of the frequencies indicated in the chart. To do this first check that the input voltage shown on Channel B is 100 mV and readjust the function generator output level if necessary. Watch Channel A and record the output level. Record the input and output voltage in columns 2 and 3 on the chart. Be careful not to change the volume control while recording your data. If you accidentally do change it, start over.

D. We noted that manufacturers give the frequency response of an amplifier in dB relative to its response at a particular frequency. We will use 1 kHz as our reference frequency (where your amplifier's response was 0.4 V). Make a graph of Response (dB) versus Frequency (Hz) for your data obtained in step C. To calculate the response in dB, use the equation:

$$\text{Response (dB)} = 20 \log [V_{output} / 0\ 4]$$

Use the data in column 3 and record your response in column 4. This procedure converts the voltage response to a decibel response relative to 0 dB at 1 kHz. The calculation is easily accomplished on any calculator that can handle logarithms as follows:

> Suppose your voltage is 0.35 V. Enter .35 into the calculator and divide by .40. The result will read 0.875. Press the log key. Your calculator will show -0.058 (after rounding off). Multiply by 20. Your response will be -1.2 dB. [If the voltage had been 0.45 V, the response would have been +1.0 dB.]

Question: What is the range of frequencies (highest and lowest) for which the amplifier's response is constant within 3 dB? This is called the 3 dB frequency response of the amplifier and is often quoted by the manufacturer.

Frequency (Hz)	Input (V)	Output (V)	Response (dB)
20			
50			
100			
500			

1 k			
5 k			
10 k			
20 k			

E. Make a plot of the Response (dB) versus Frequency (Hz). Connect your data with a smooth hand drawn curve. Clearly label each curve.

Question: Does this amplifier qualify as high fidelity equipment? Explain.