The Fourth Experiment

Calculation of the noise pollution level in the laboratory

The Objective of the experiment:

How to calculate average noise pollution from sound level measurements within a pollution laboratory.

The Theoretical Part:

Noise is considered one of the types of environmental pollution, and it is defined as heterogeneous sounds whose intensity exceeds the normal permissible rate for the ear. Noise is measured in decibels (dB), which is the unit of sound intensity. The sound has several characteristics, the most important of which are [35]:

1. Sound intensity: the ear distinguishes between a strong sound and a weak sound.
2. Degree sound: Distinguish between sharp and thick sound.
3. Type of sound: a difference in the tone of the voice, even if its intensity and degree are equal.

In fact, the noise level should be less than 25 Db in order for a person to sleep and rest, but if it exceeds this limit, exposure to noise has effects on the general health of the person, both organically and psychologically, as it harms the auditory and nervous systems and affects the digestive and nervous systems, heart and circulation. bloody; As well as its effects on animals and birds. In any case, the extent of the impact of noise depends on the source of the sound and the receiver (whether humans or animals) and on the medium that transmits the sound. The following table (7-1) shows the values of some noise levels resulting from pollution sources.

Noise sources stem from two main sources:

1. Natural sources: such as volcanoes, earthquakes, thunder, hurricanes, and others.
2. Unnatural sources: factories of all kinds, trains, cars, and others.

Noise depends on ten important factors:

1. Long exposure to noise.
2. distance from the source.
3. Air absorbency.
4. Wind.
5. Source type (point or linear).
6. Temperature and temperature regression.
7. Barriers such as bridges and data.
8. Reflections.
9. Humidity
10. precipitation.

One of the most prominent indicators of measuring diffuse noise is done with a sound level meter (it is the percentage of time during which the sound level has increased), but some statistics must be applied to the results. This ratio is denoted by the capital letter L with a lowercase symbol. For example, L10-70 Db means that 10% of the time the noise is louder than 70 dB. The diffuse noise data is taken by reading the sound levels at regular intervals, while the data is arranged and plotted and L values are extracted from the graph.

One of the most widely used indicators to measure the level of perceived noise from its sources is the Noise pollution level (NPL) which takes into account the excitement caused by the impulse noise. NPL is defined by the following mathematical equation [9]:

$$\mathrm{NPL(dB)} = L_{50} + (L_{10} - L_{90}) + \frac{(L_{10} - L_{90})^2}{60}$$

Table (7-1): Threshold limits for noise level tolerance.

Noise Level (dB)	**Sources**
0	Hearing threshold for the lowest sound
20	Inside a quiet room at night

20	clock chimes
30	quiet garden
40	Average residential area
50	working circle
60	Word Conversations
70	heavy traffic
80	loud radio music ,Police car, noisy pavement
Hearing loss begins	
90	Weddings, trains, cars
100	heavy trucks
110	Jets, speakers
150	Jet planes (take off)

TheMaterials and Tools used

Sound level meter.
2. Loud tuning fork with kickstand.
3. Elastic stand.
4. An electronic stopwatch containing seconds.
5. 3 graph paper.
6. Metric ruler.

The Method of Work

1. Make sure the device is running, especially the battery is working well.
2. Take the fork and hit it hard with the rubber stopper and put it on its stand and set it at the zero distance.
3. Measure the sound level reading after 15 sec of the fork stroke at a distance of 10 cm and record your results in the table below.

4. Measure the sound level every 15 sec with a dimension of 10 cm.
5. Repeat the previous step 9 times, recording your results in the following table:

Time (sec)	D (cm)	SL (dB)	Rank		
15	10	70.2	1		
30	20	73.5	2		
45	30	80.1	3		
60	40	89.2	4		
75	50	55.3	5		
90	60	60.5	6		
105	70	79.1	7		
120	80	40.4	8		
135	90	78.2	9		
150	100	90.5	10		

6. Calculate the frequency of the values to find the percentage of time equal to or greater than the SL readings, with the relationship:

$$\%\text{of time} = \left(\frac{\text{m}}{\text{N}}\right) * 100 \quad .7$$

Where m is the rank number and N is the number of observations.

7. Make a graph between the greater or equal % of time values on the y-axis and the SL(dB) values in ascending order.

8. Pass the curved line that best passes through the points of the graph

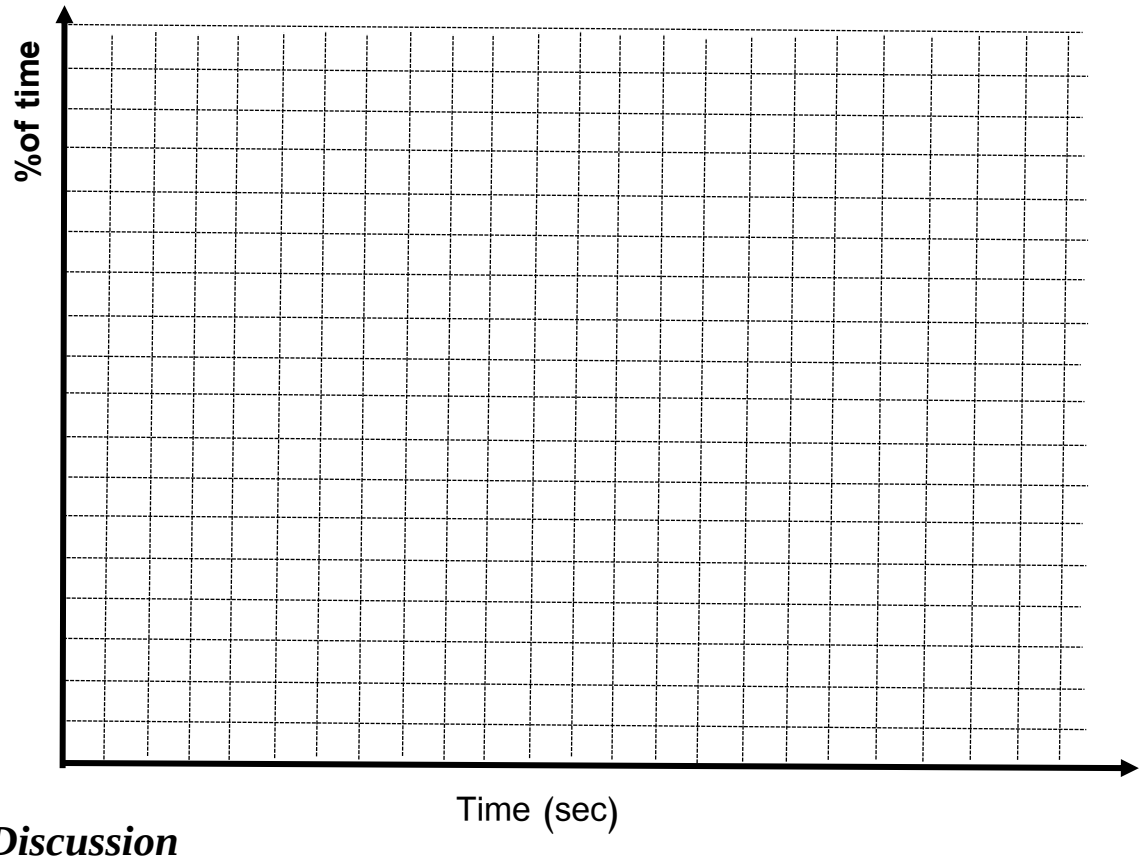
9. Starting from the y-axis find the values of L_{10}, L_{50}, L_{90} from the % of time values of 10, 50 and 90 and pass parallel to the x-axis and at the intersection with the curve of the best line, go down to the x-axis and record the values of SL that correspond to the values of L_{10}, L_{50}, L_{90}.

10. Calculate the value of $(NPL)_1$ using the equation (7-1)

11. Repeat Experiment Steps 1 to 10 again to calculate$(NP)_2$

12. Calculate the average noise pollution level $\overline{(NPL)}$in the laboratory and that .

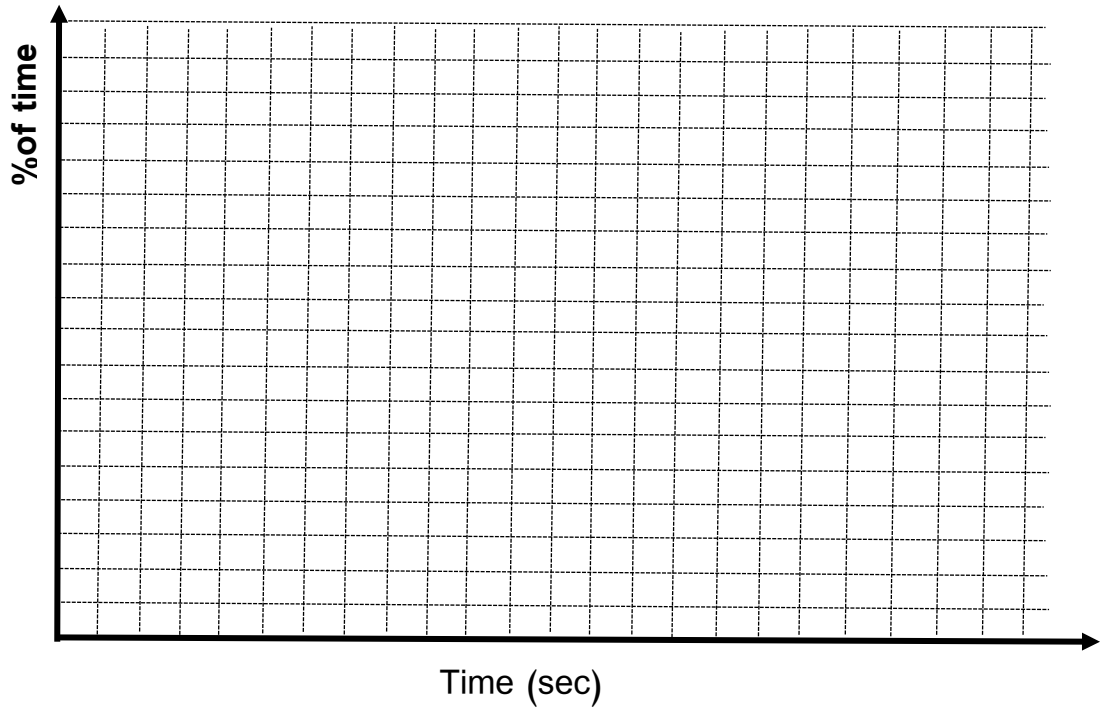
$$\overline{\mathrm{NPL}} = \frac{(\mathrm{NPL})_1 + (\mathrm{NPL})_2}{2}$$



Discussion

Q1: Compare the end result of the experiment with Table (7-1)?

Q2: Discuss the type of graphic relationship between SL values with distance by drawing them on graph paper combined for the two equations?



Q3: Explain the effect of noise on the extent to which students comprehend other experiences, as well as the effect on understanding the teacher's explanation of a specific theoretical subject in the classroom?

Q4: Explain how the sound level device works, illustrating the schematic diagram of its components?

Q5: Explain why some sounds are louder when they approach the recipient (people) while they start to become weaker when they leave?

Q6: Mention the most important measures necessary to reduce and reduce the noise level in society?

Good Luck

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