That auditory stimulus or stimuli bearing no informational relationship to the presence or completion of the immediate task.

Humans are more sensitive to high frequencies of equal intensity than the lower frequencies.

**LOUDNESS** -- subjective and psychological experience related to both the intensity and the frequencies.

- Sound level meter Scales (Fig 18-1)
- Psychophysical indices
  1. Phon
  1000 Hz tone
  2. Sone - relative loudness
  4 phons = 1 sone
  2 sones = twice loudness

3) Equivalent Sound Level
   Long Term Average
4) Table 18-1

**NOISE and Loss of Hearing**

(A) **DEAFNESS**

1. Nerve
   - result from damage or degeneration of the hair cells of the organ of Corti in the cochlea of the ear. (Uneven deafness) more damage in higher frequency than lower frequency
   - cause is aging and continuous exposure to high noise. Once it occurs it can rarely be remedied.

2. **Conduction**
   - caused by some condition of the outer or middle ear that affects the transmission of sound waves to the inner ear, such as:
     a. Adhesion in the middle ear, prevents vibration of the ossicles.
     b. Infection of the middle ear

3. **Hearing Loss**

   (2) continued
   c. Wax or some other substance in the outer ear
   d. Scars resulting from a perforated eardrum.
(B) MEASURING HEARING

1) Audiometer test
   - Threshold frequency test.
   - The lowest frequency one can detect.

2) Simple hearing tests (not very standardized)

(C) SURVEYS OF HEARING LOSS

1.) Presbycusis (Fig. 18-3)
   - Due to aging (55%)

2.) Sociocusis
   - Due to nonoccupational noise sources, such as household noises, TV, radio, traffic, etc.

3.) Occupational hearing loss
   a.) Temporary hearing loss from continuous noise
      - It takes less than 1/2 hr. to acquire TTS (temporary threshold shift) of 25 dBA, but complete recovery may take up to 16 hr.
      - Can have serious consequences if a person depends on auditory information in the performance of a job or task.

b.) Permanent hearing loss from continuous noise
   - With repeated exposure to noise of sufficient intensity a permanent threshold shift (PTS) will appear.
   - Starts @ 4000 Hz (if continued, it will spread)

   c.) Hearing loss due to non-continuous noise
      i.) Gunshot
      ii.) Explosion

PHYSIOLOGICAL EFFECTS OF NOISE

A.) Startle response

B.) 8-year study on 200,000 residents living near LA International Airport reported that:
   - Death rate from heart attack (>75 yrs.) and suicides (45-50 yrs.) to be higher than those quieter areas near by (noise level was measured @ 115 dBA)

EFFECTS OF NOISE ON PERFORMANCE

A.) CONCLUSION

1.) The level of noise required to obtain reliable performance effect is quite high (95 dBA)

2.) Performance of simple, routine tasks may show no effect and often will even show an improvement as a result of noise.

3.) The detrimental effects of noise are usually associated with tasks performed continuously without rest pauses between response.
B.) SPECIFIC EFFECTS OF NOISE

1.) Certain decisions become more confident in the presence of noise.

2.) Easily detected signals are usually not missed any more often in more noise conditions that in quiet conditions.

3.) “funneling of attention”

4.) Gaps of performance — large variability of performance but the average is the same.

EFFECTS OF NOISE ON PERFORMANCE

A.) CONTINUOUS & INTERMITTENT NOISE

Permissible Noise Exposures According to OSHA

<table>
<thead>
<tr>
<th>sound level (dBA)</th>
<th>permissible time (hours)</th>
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<tbody>
<tr>
<td>80</td>
<td>32</td>
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<tr>
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<tr>
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<td>0.063</td>
</tr>
<tr>
<td>130*</td>
<td>0.031</td>
</tr>
</tbody>
</table>

Noise Dose

Partial dose = (time spent / time permissible) x 100

4-hour Time Weighted Average

Sound level to produce noise dose if continuous over 8 hours (Table 18-4)

NOISE EXPOSURE LIMITS

B.) IMPULSE NOISE

— a sound with a rise time of not more than 35 msec to peak intensity and duration of not more than 500 msec to the time when the level is 20 dB below the peak

ANNOYANCES OF NOISE

RATING

1.) noticeable
2.) intrusive
3.) annoyance
4.) unbearable

HANDLING NOISE PROBLEMS

NOISE CONTROL

1.) At the source
2.) Along the path
   - High frequencies
   - Reverberation from walls
3.) At the receiver