TIBBIY VA BIOLOGIK FIZIKA FANIDA TOVUSHNING HAVODA TARQALISH TEZLIGI

Buzrukov To‘lqin Omonovich PhD, dotsent
Email: tolqinbuzrukov5@gmail.com
Ergashova Gavhar Ravshanovna

Annotatsiya

Tovush — bu muhit zarrachalarining tebranishi orqali tarqaladigan mexanik to‘lqin bo‘lib, uning havodagi tarqalish tezligi tibbiy va biologik fizika fanida muhim ahamiyatga ega. Ushbu maqolada tovushning havoda tarqalish mexanizmi, tezlikka ta’sir qiluvchi omillar (harorat, zichlik, bosim), hamda tibbiyotdagi qo‘llanilishi (ultratovush diagnostikasi) keng yoritiladi. Maqola IMRAD strukturasida yozilgan bo‘lib, ilmiy va tushunarli tarzda bayon etilgan.

Kalit so‘zlar: tovush, tezlik, ultratovush, mexanik to‘lqin, akustika, biologik fizika

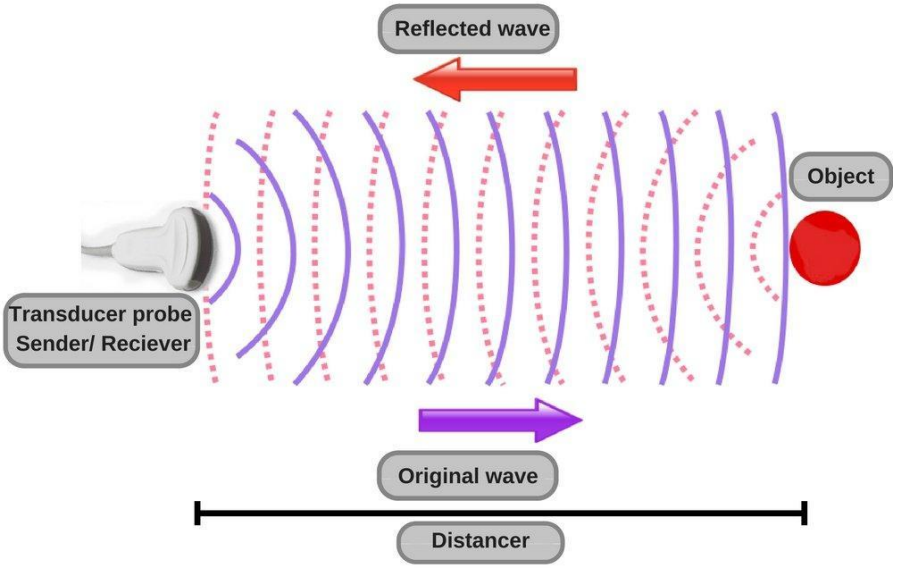
Kirish

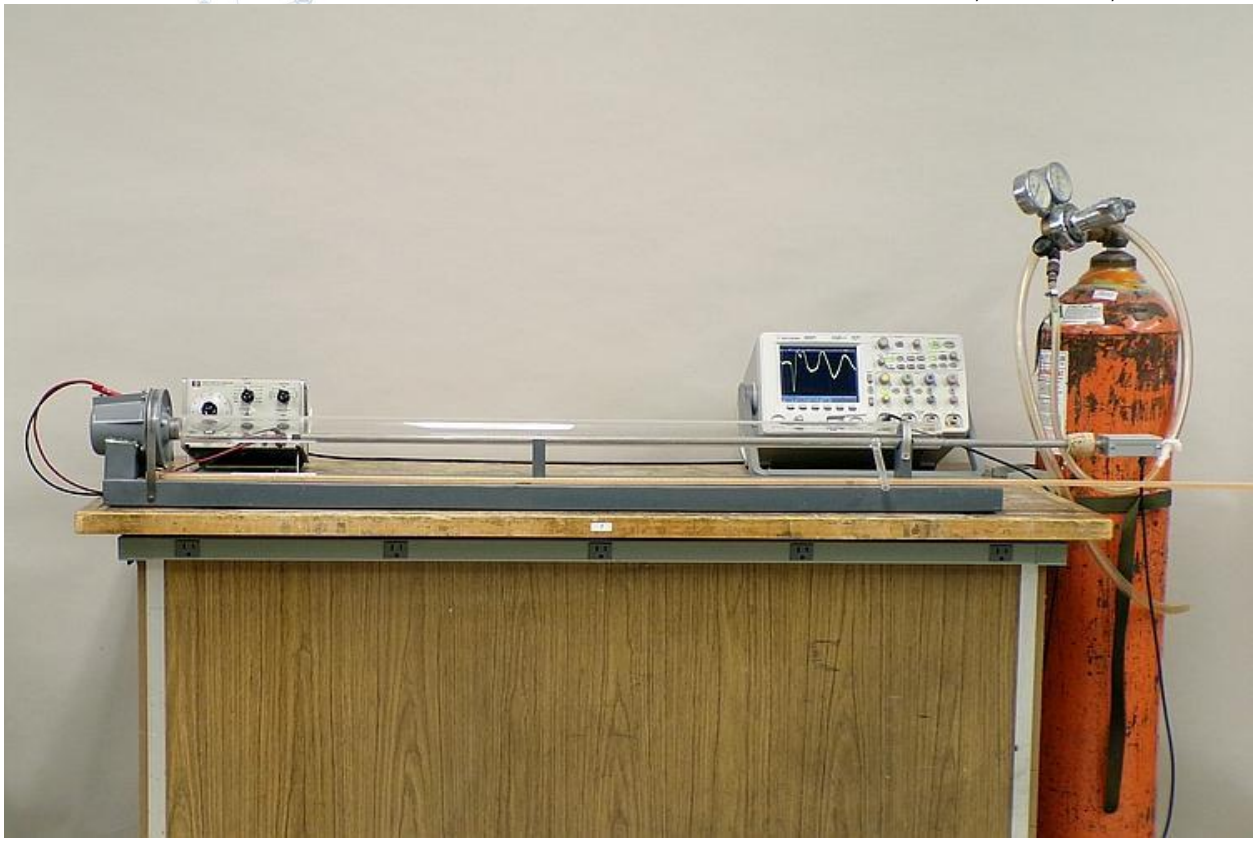
Tovush inson hayotida muhim o‘rin tutadi. U nafaqat aloqa vositasi, balki tibbiyotda diagnostika va davolash jarayonlarida ham keng qo‘llaniladi. Tovush — bu elastik muhitda (masalan, havoda) tarqaladigan mexanik tebranishdir.

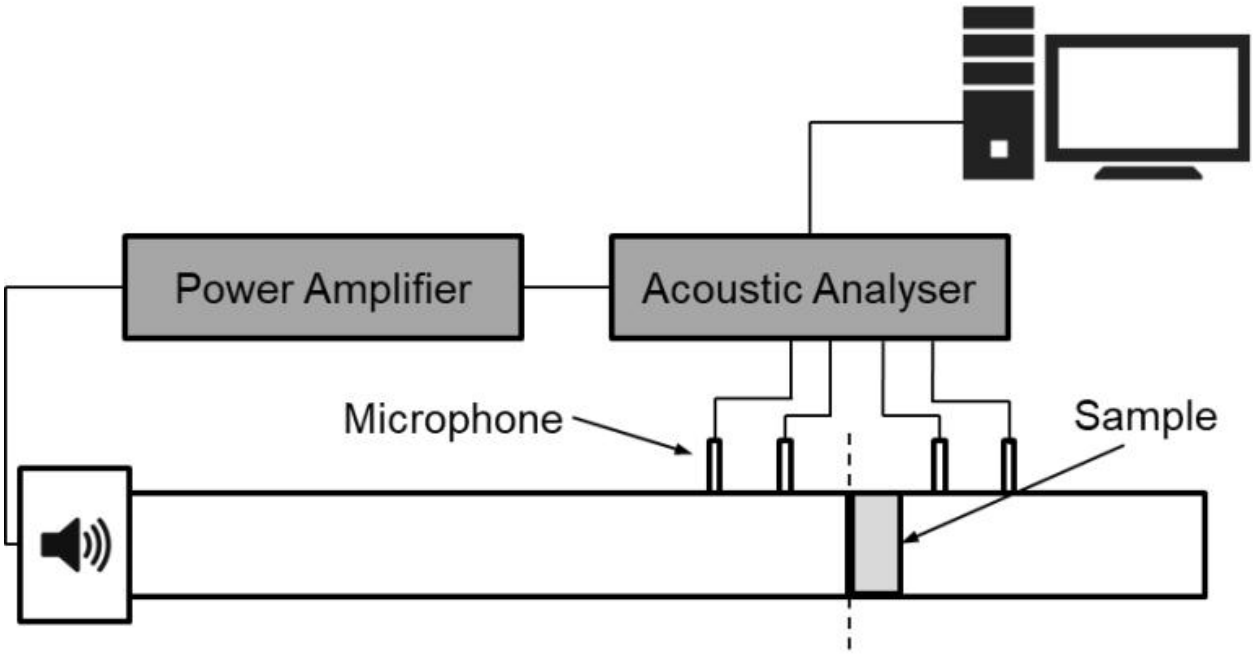
Havoda tovush uzunlamas to‘lqin sifatida tarqaladi, ya’ni zarrachalar tebranish yo‘nalishi to‘lqin yo‘nalishiga parallel bo‘ladi. Tovush tezligi esa muhit xossalariga bog‘liq bo‘lib, ayniqsa harorat katta ta’sir ko‘rsatadi.

Tibbiy fizikada tovush tezligini bilish muhim, chunki u ultratovush apparatlarida tasvir hosil qilish asosini tashkil etadi.

Materiallar va usullar







Ushbu maqola nazariy tahlil asosida yozilgan:

Manbalar:

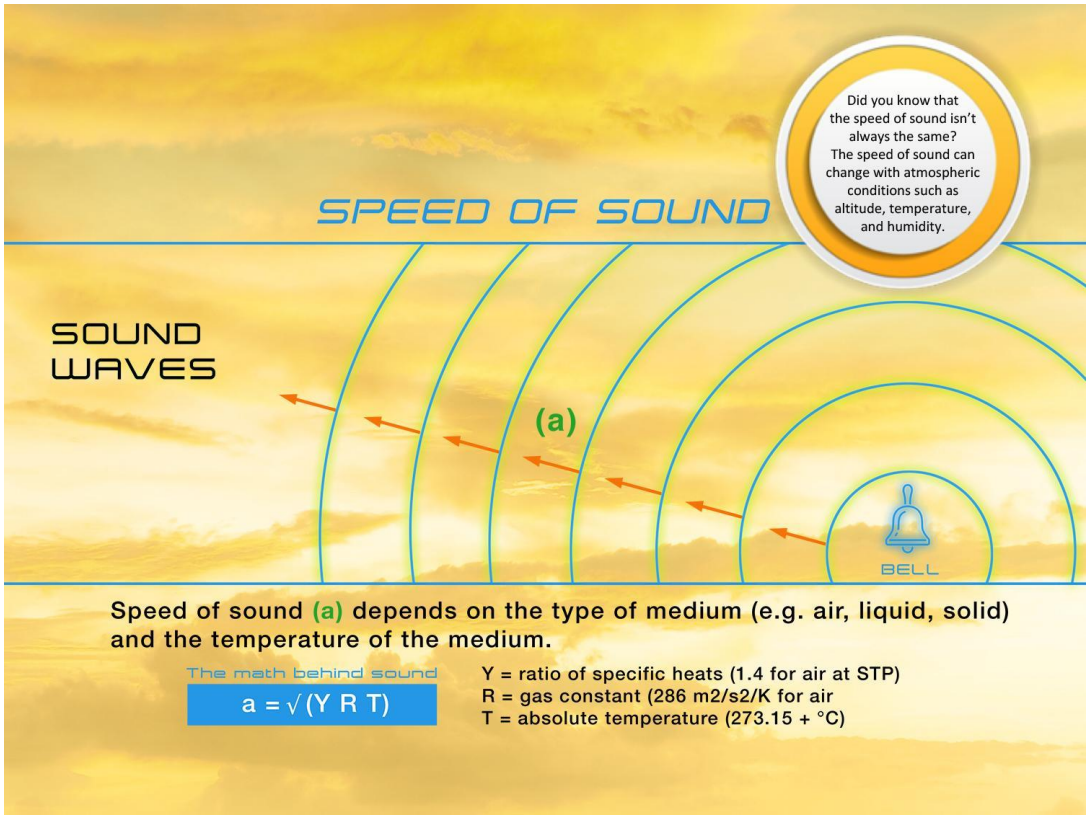
- Biologik fizika va akustika darsliklari
- Ilmiy maqolalar (Scopus, PubMed)
- Tibbiy ultratovush texnologiyalari

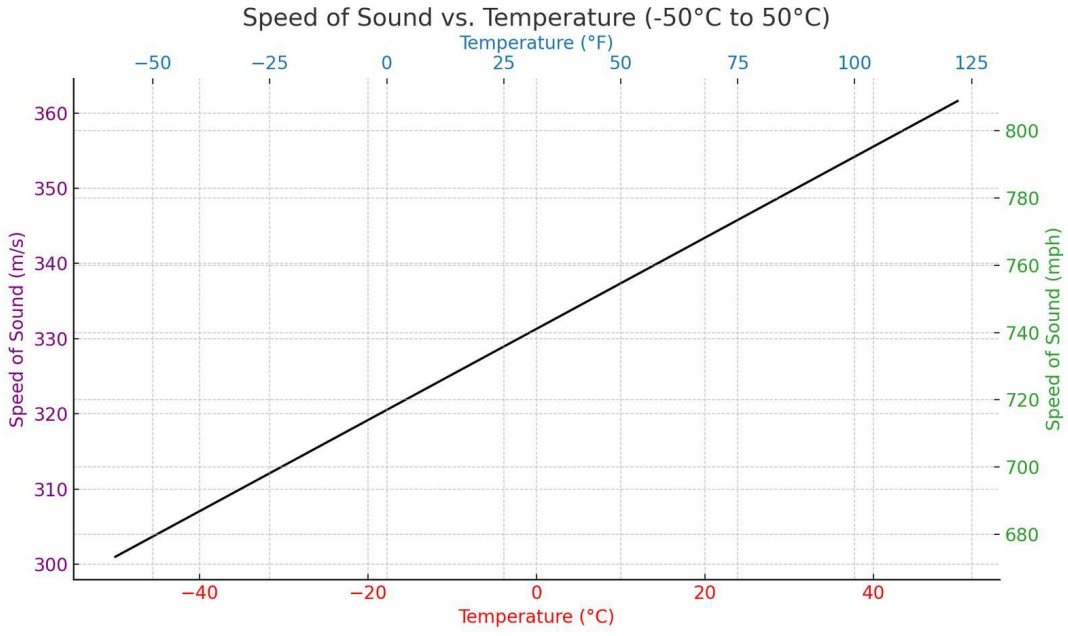
Usullar:

- Analitik tahlil
- Formulalar asosida tushuntirish
- Grafik va diagrammalar bilan izohlash

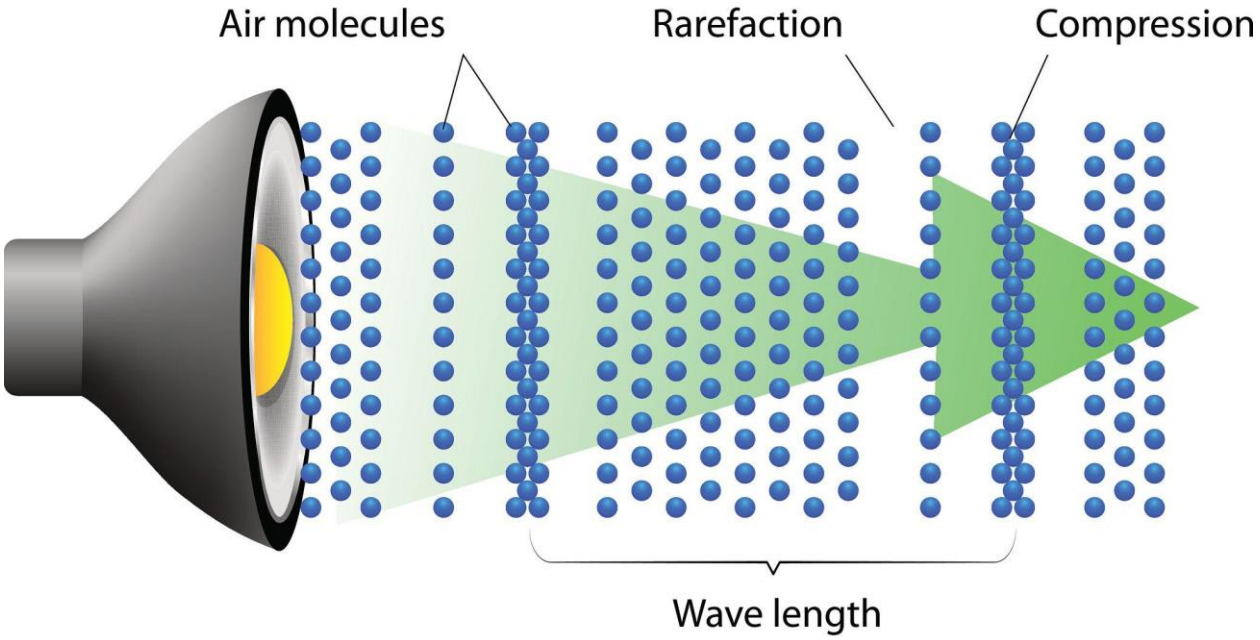
Natijalar

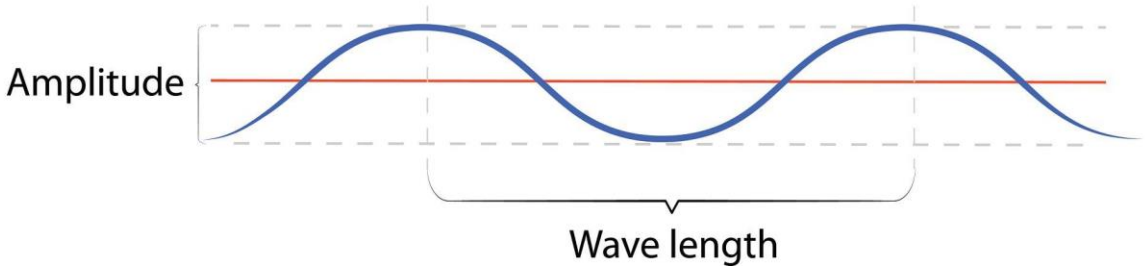
1. Tovushning havoda tarqalish tezligi

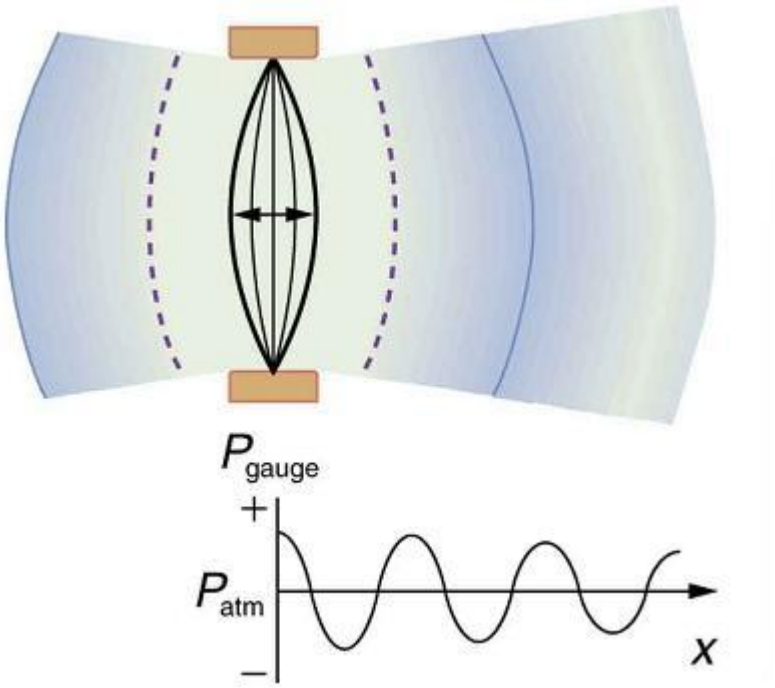


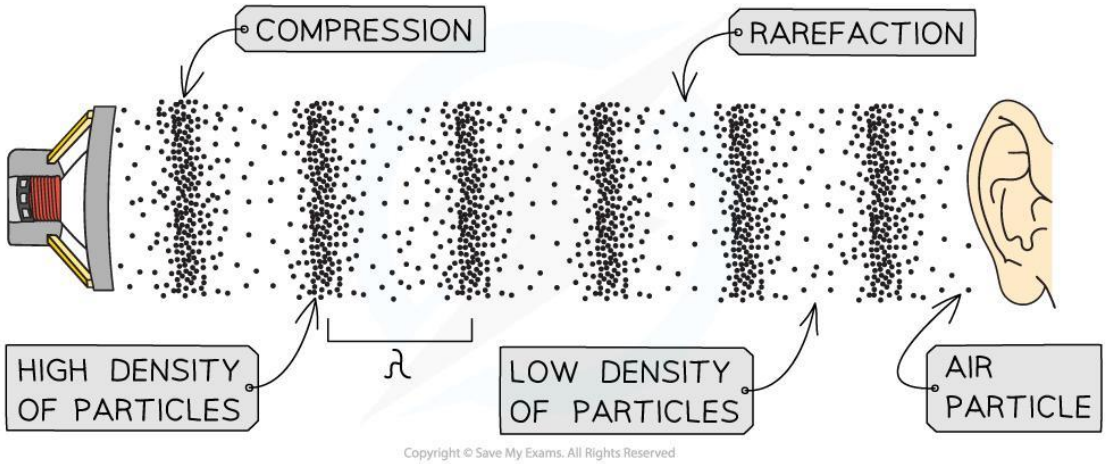


SOUND WAVES


Air molecules
Rarefaction
Compression
Wave length


Amplitude
Wave length


P_{gauge}
+
P_{atm}
−
x



Havoda tovush tezligi taxminan:

- **20°C da: 343 m/s**

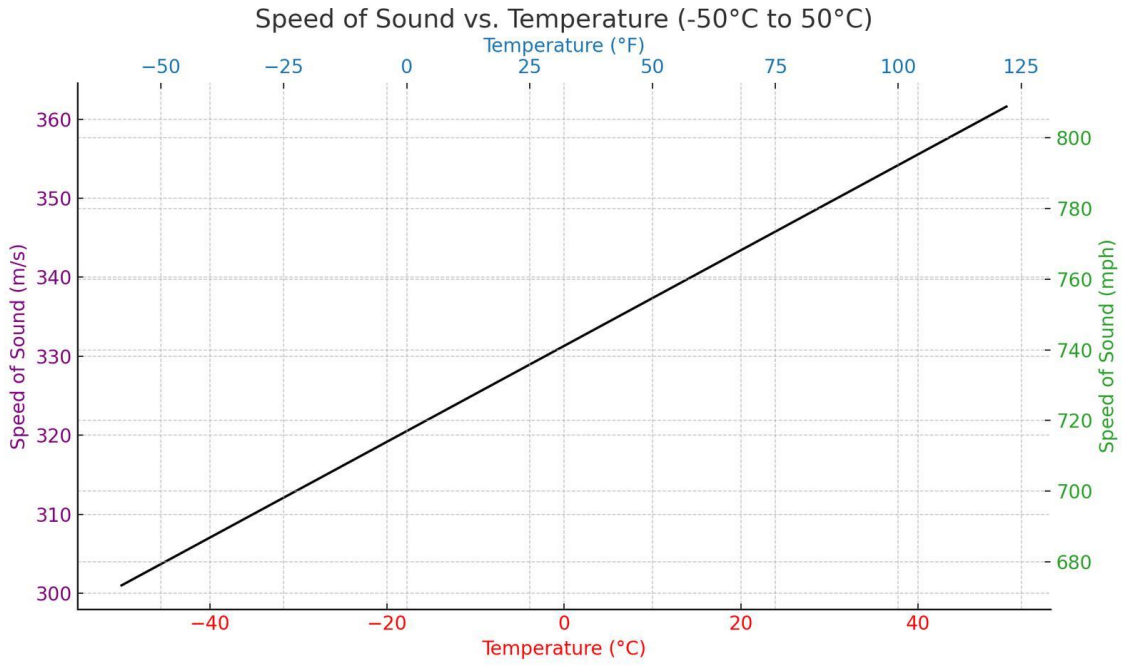
  Tovush tezligi formulasi:

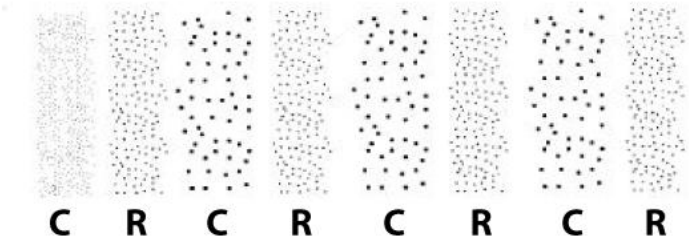
  [
v = \sqrt{\gamma \cdot \frac{R \cdot T}{M}}
]

  Bu yerda:

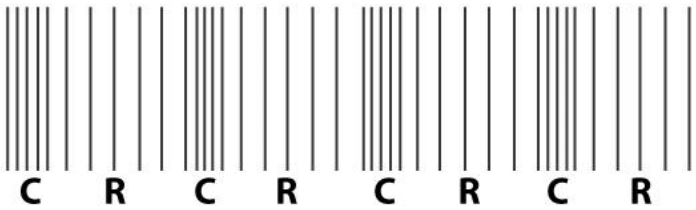
- (v) — tovush tezligi
- (T) — harorat (Kelvin)
- (\gamma) — adiabatik ko‘rsatkich
- (M) — gazning molyar massasi

2. Tovush tezligiga ta’sir qiluvchi omillar

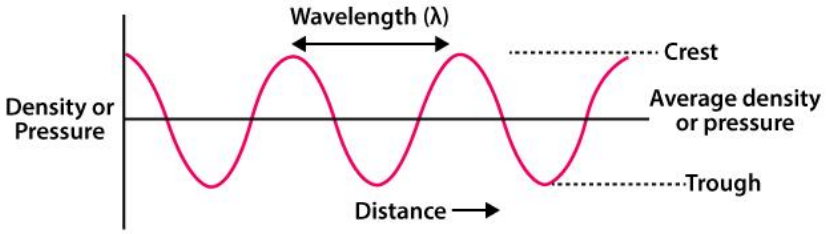


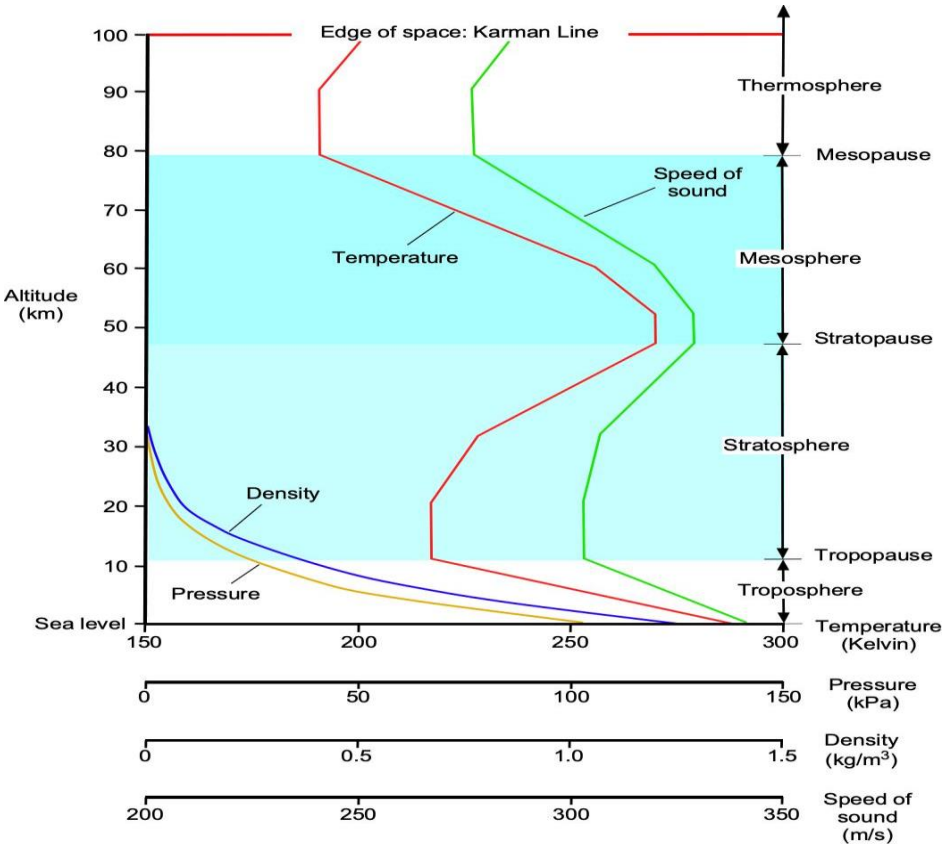


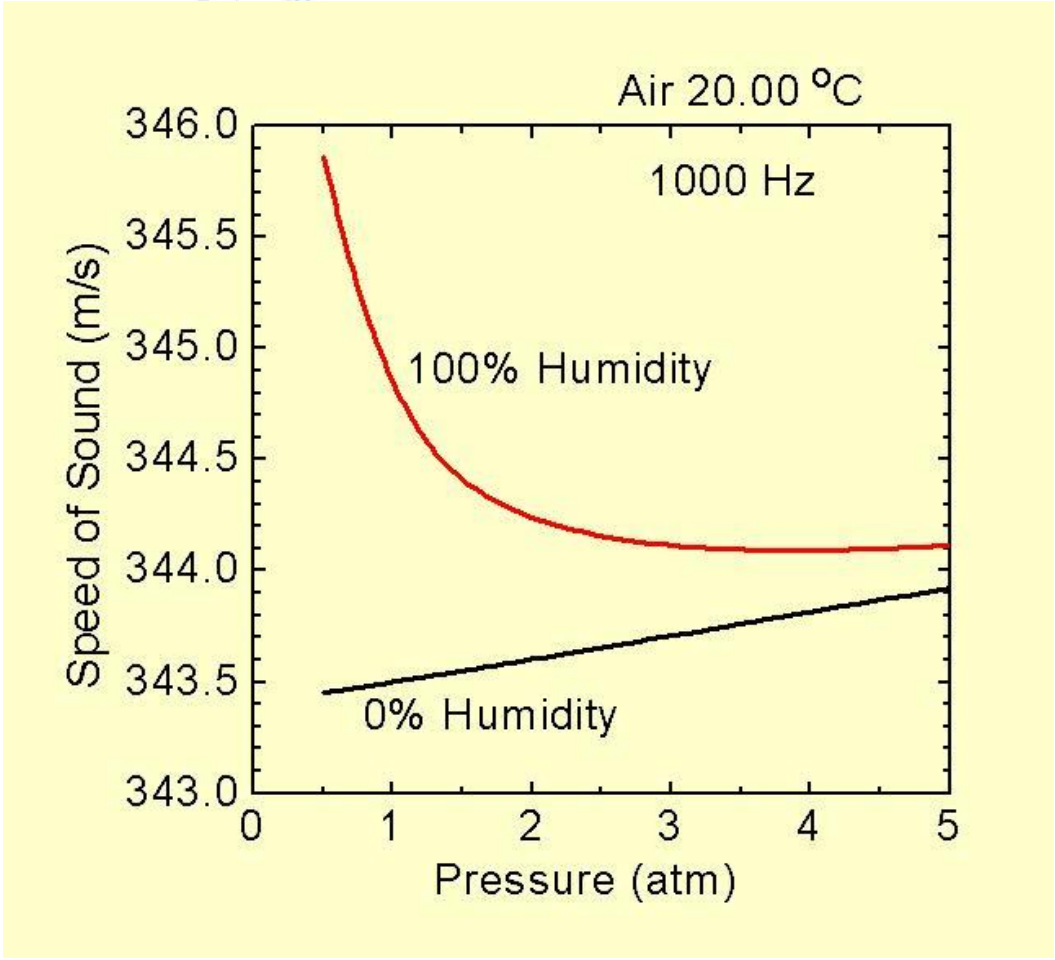
Density variations

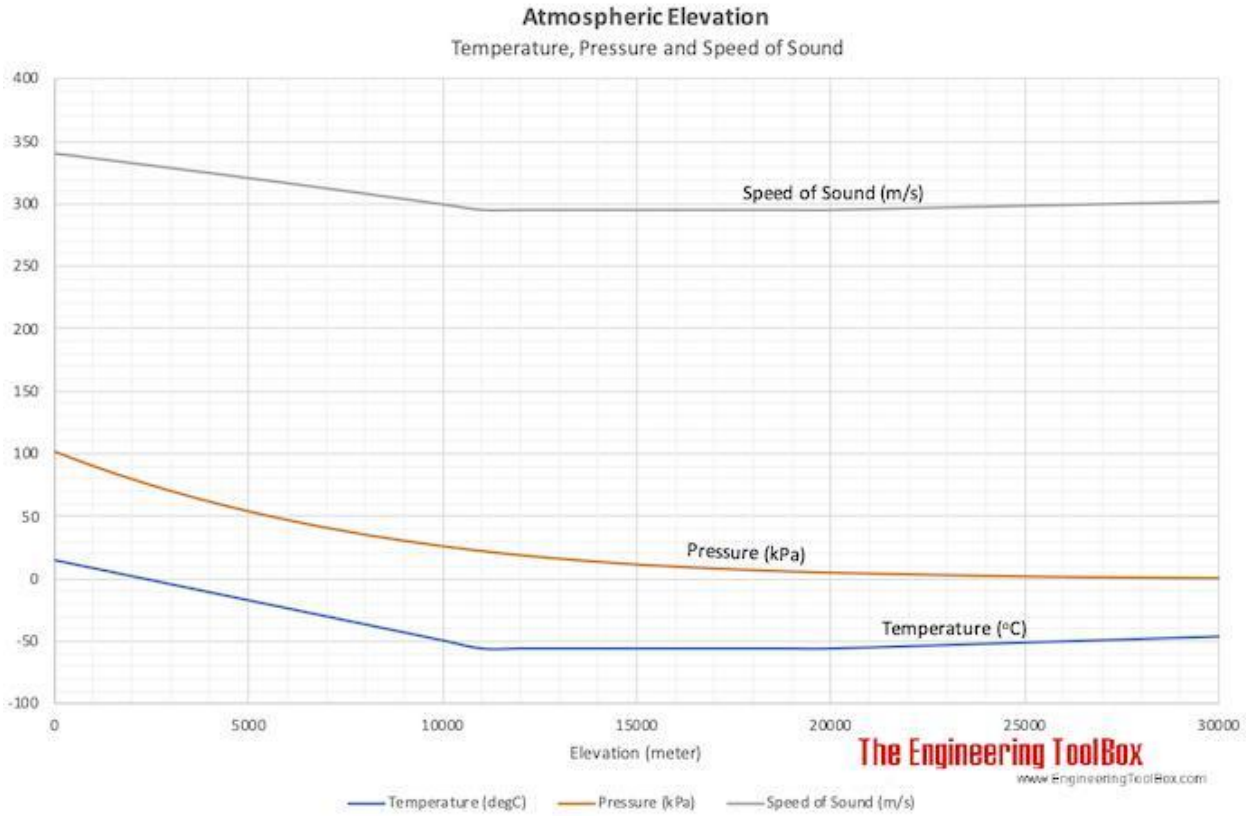


Pressure variations



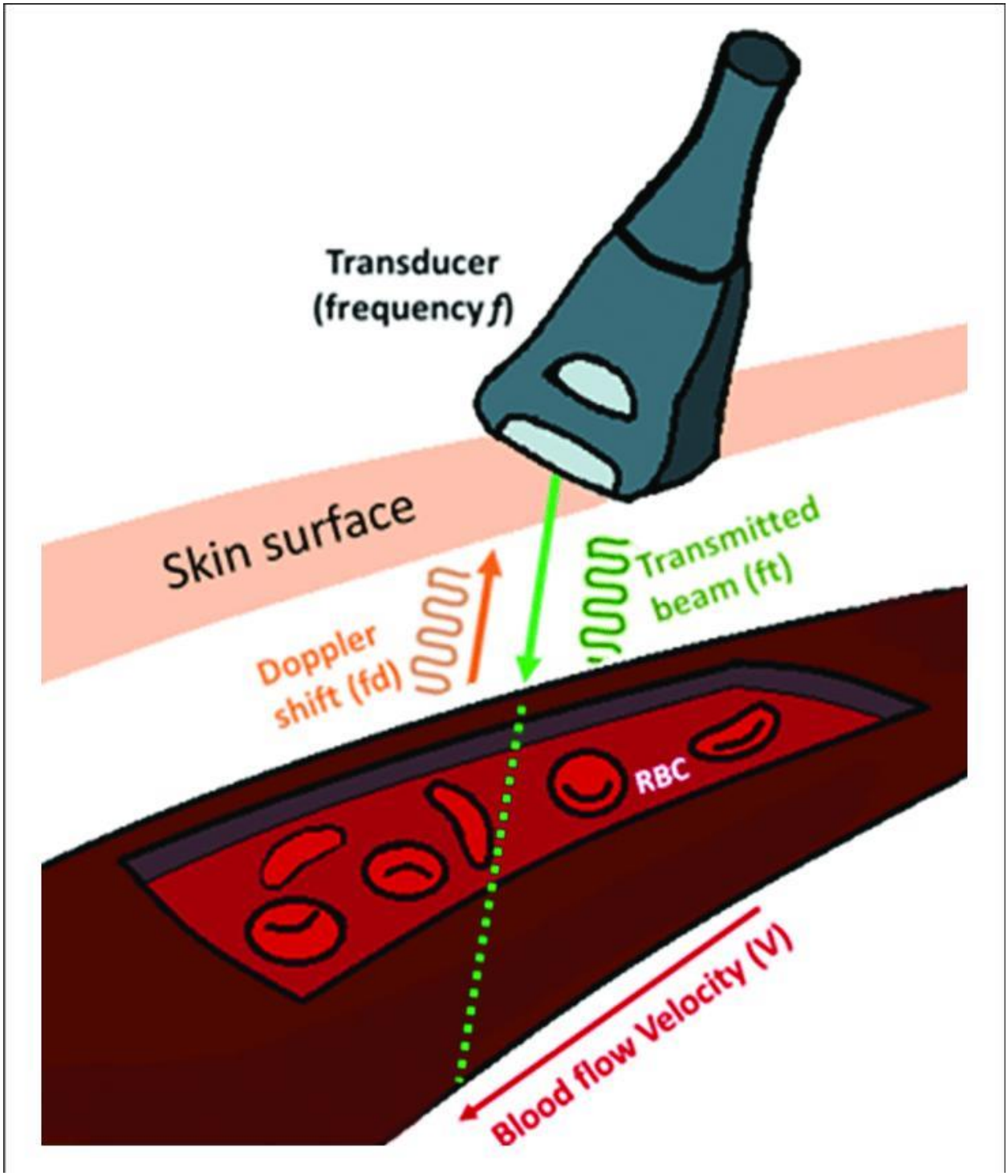


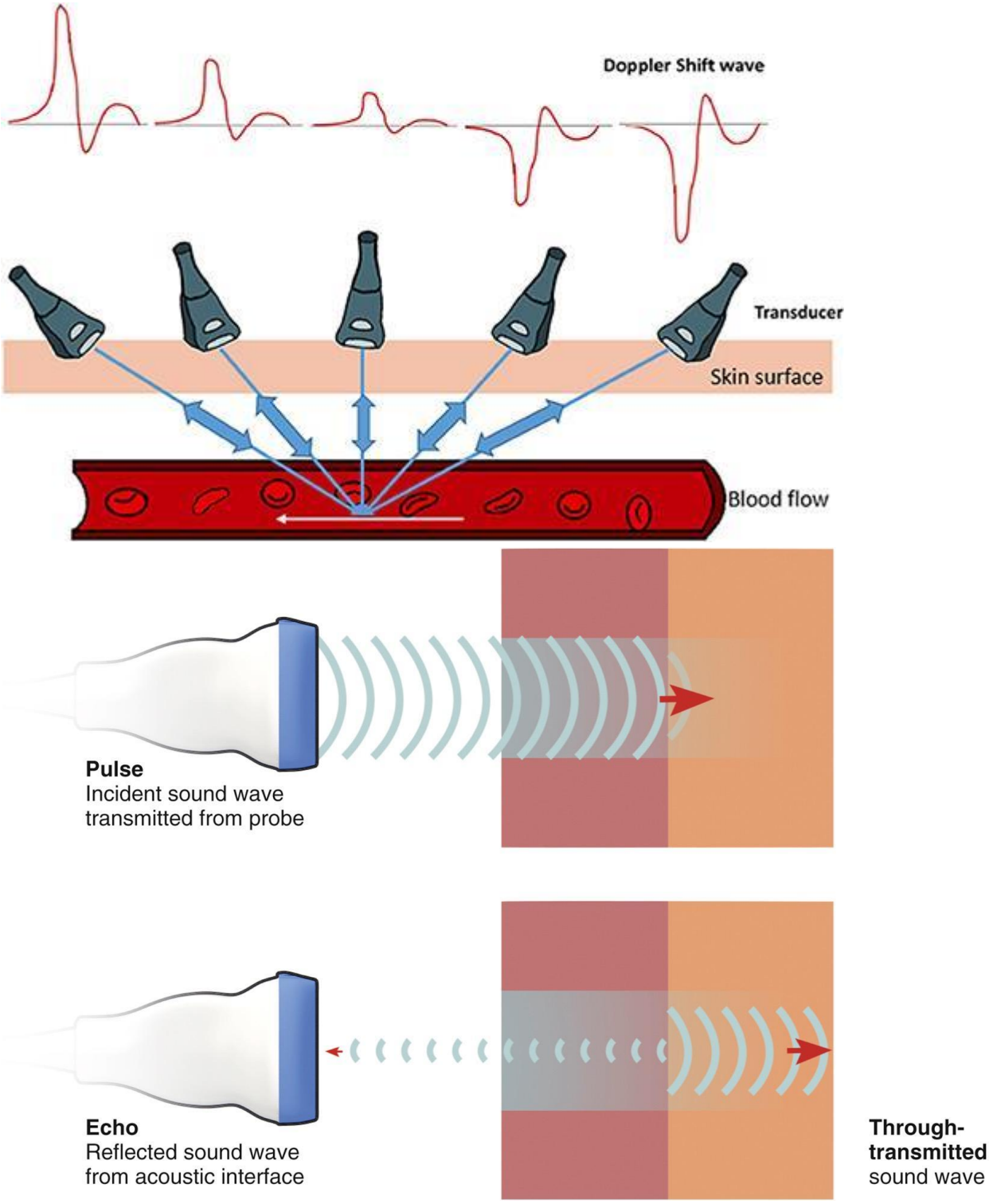

Air 20.00 °C
1000 Hz
100% Humidity
0% Humidity
Speed of Sound (m/s)
346.0
345.5
345.0
344.5
344.0
343.5
343.0
0
1
2
3
4
5
Pressure (atm)

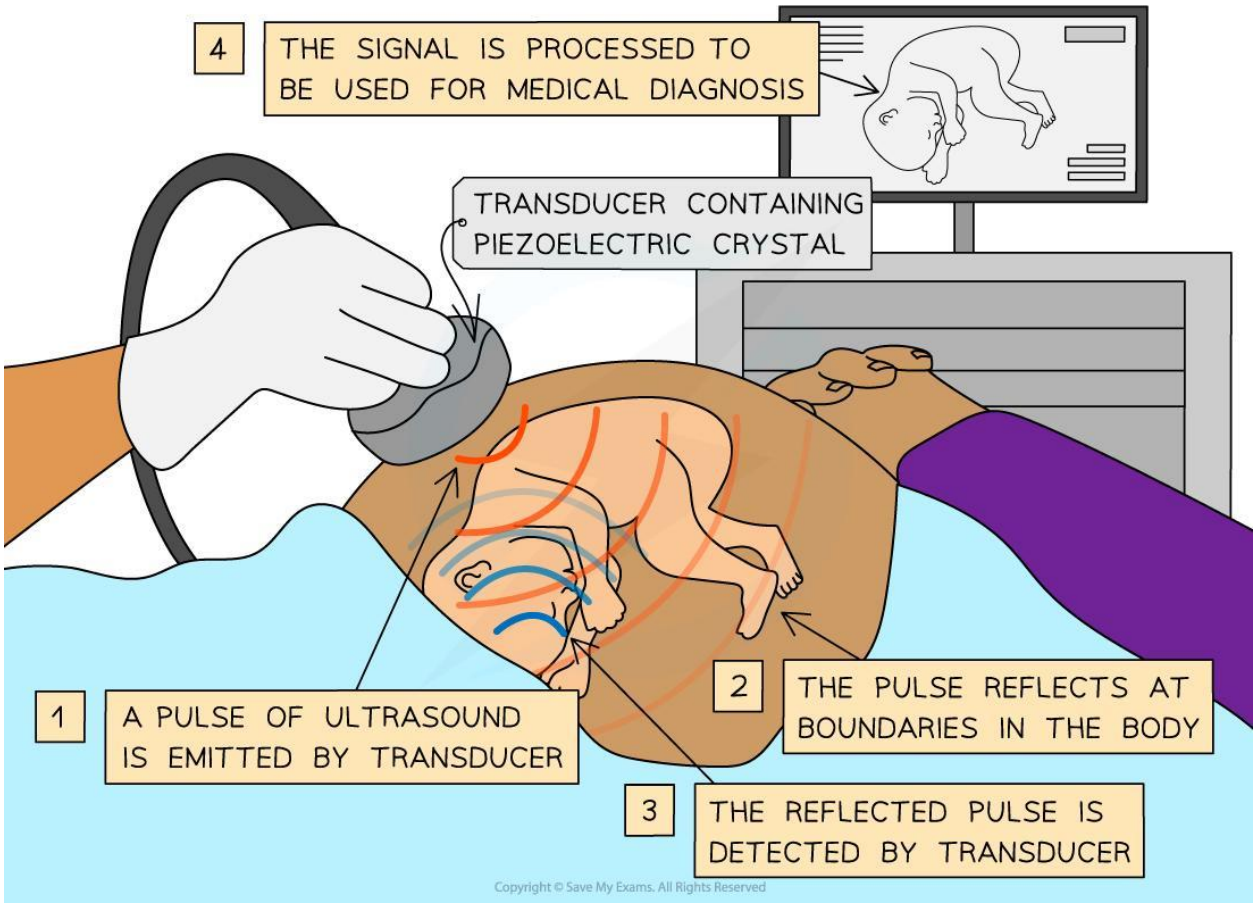

Atmospheric Elevation
Temperature, Pressure and Speed of Sound
Speed of Sound (m/s)
Pressure (kPa)
Temperature (°C)
400
350
300
250
200
150
100
50
0
-50
-100
0
5000
10000
15000
20000
25000
30000
Elevation (meter)
The Engineering ToolBox
www.EngineeringToolBox.com
Temperature (degC)
Pressure (kPa)
Speed of Sound (m/s)

- **Harorat** ↑ → tezlik ↑
- **Zichlik** ↑ → tezlik ↓
- **Namlik** ↑ → tezlik ↑
- **Bosim** kam ta’sir qiladi

3. Tovushning biologik va tibbiy ahamiyati

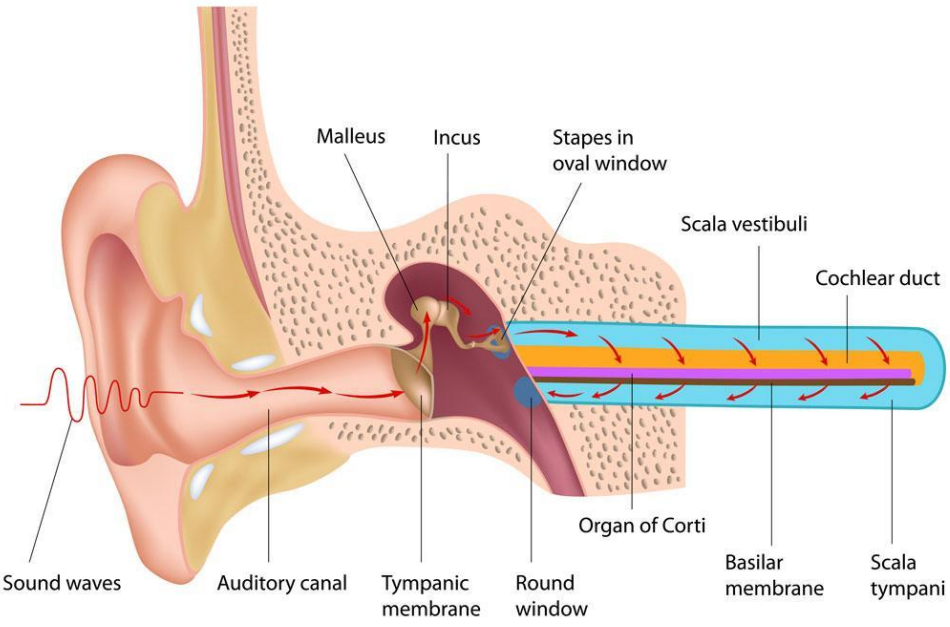



Doppler Shift wave
Transducer
Skin surface
Blood flow
Pulse
Incident sound wave
transmitted from probe
Echo
Reflected sound wave
from acoustic interface
Through-
transmitted
sound wave



- Ultrasonografiya (UZI) — ichki organlarni tekshiradi
- Doppler — qon oqimini o‘lchaydi
- Tovush tezligi asosida masofa aniqlanadi

Muhokama



Tovushning havoda tarqalishi tibbiyotda muhim bo‘lsa-da, uning ayrim cheklovlari mavjud:

- Havoda energiya tez so‘nadi
- To‘siqlarda akslanish va sinish sodir bo‘ladi
- UZI asosan suyuq va yumshoq to‘qimalarda yaxshi ishlaydi

Bundan tashqari, ortiqcha tovush (shovqin) inson eshitish tizimiga zarar yetkazishi mumkin.

XULOSA

Tovushning havoda tarqalish tezligi tibbiy va biologik fizika fanida fundamental tushunchalardan biri hisoblanadi. Ushbu hodisa oddiy mexanik tebranish sifatida qaralishiga qaramay, uning asosida murakkab fizik qonuniyatlar yotadi. Tovush — bu uzunlamas to‘lqin bo‘lib, u havoda zarrachalarning siqilish (kompressiya) va siyraklashish (rarefaksiya) jarayonlari orqali tarqaladi.

Tadqiqotlar shuni ko‘rsatadiki, tovush tezligi muhitning fizik xususiyatlariga bevosita bog‘liq. Ayniqsa, harorat oshishi bilan molekulalarning kinetik energiyasi ortadi va bu tovush tezligining oshishiga olib keladi. Shu bilan birga, muhit zichligi va tarkibi ham muhim rol o‘ynaydi. Masalan, gazlarda tovush suyuqlik va qattiq jismlarga qaraganda sekinroq tarqaladi.

Tibbiyotda tovushning fizik xususiyatlari, ayniqsa ultratovush (UZI) texnologiyasida keng qo‘llaniladi. Ultrasonografiya ichki organlarni invaziv bo‘lmagan usulda tekshirish imkonini beradi. Bu usul tovush to‘lqinlarining turli to‘qimalardan qaytish (refleksiya) xususiyatiga asoslanadi. Doppler usuli esa qon oqim tezligini aniqlashda qo‘llaniladi va yurak-qon tomir kasalliklarini diagnostika qilishda muhim ahamiyatga ega.

Shuningdek, tovushning biologik ta’siri ham muhim hisoblanadi. Me’yoriy tovush inson uchun foydali bo‘lsa, yuqori intensivlikdagi shovqin eshitish tizimiga zarar yetkazishi mumkin. Shu sababli akustik muhitni nazorat qilish gigiyena va profilaktika nuqtai nazaridan muhimdir.

Xulosa qilib aytganda, tovushning havoda tarqalish tezligi nafaqat fizik hodisa, balki tibbiyotda keng qo‘llaniladigan amaliy vosita hamdir. Ushbu bilimlar zamonaviy diagnostika usullarining rivojlanishiga asos bo‘lib xizmat qiladi va inson salomatligini saqlashda katta ahamiyatga ega.

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