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# Sonography Tech (Quickstudy: Academic)

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**WORLD'S #1 ACADEMIC OUTLINE**

**Sonography Tech**

Essentials of Physics & Sound, Image Interpretation, Tools, Techniques, Equipment & Terminology

**OVERVIEW**

**Scope of Practice**

- **Diagnostic** (i.e., **ultrasonography**) involves the following aspects:
  - medical equipment and technology
  - patient care
  - quality control
  - diagnostic procedures
  - computer data acquisition & processing
- **Diagnostic** technology is a **multidisciplinary field**, in which medicine, ultrasound, mathematics and computer sciences, including:
  - anatomy
  - physics
  - computer technology
- **Diagnostic** imaging technique is used to **visualize subcutaneous body structures**, for possible **pathology** or **lesions**
- **Diagnostic** test used for **sonographic imaging** include:
  - **ultrasound**
  - **ultrasonography**
  - **ultrasound**, the term "ultrasound" applies to **ultrasonic waves** with a **frequency above human hearing** (20,000 hertz) or 20 kilohertz (kHz).
  - **Typical** diagnostic **ultrasonography** **waveforms** operate in the **frequency range** of 2-10 megahertz (MHz), thousands of times greater than the **frequency of sound waves** in the **audible range**.
  - However, the choice of **frequency** is a **trade-off** between **spatial resolution** of the image and **imaging depth**.
  - **Lower frequencies** produce **less resolution**, but **image deeper** into the **body**.
- **Image** **depth** is a **function** of the **frequency** of the **ultrasound**.

**How Ultrasound Works**

- **Ultrasonography** is **effective** for **imaging soft tissue**
- **Superficial structures** such as **muscles**, **tendons**, **tissue**, **blood** and the **neuronal fibers** are **imaged** at a **higher frequency** (7-10 MHz), which provides **better axial and lateral resolution**.
- **Deeper structures** with **less tissue** and **blood** are **imaged** at a **lower frequency** (3-5 MHz), which provides **better axial and lateral resolution** but **greater penetration** (i.e., **increased imaging depth**).
- In general, **ultrasonography** machines may be used for most imaging purposes; **specialty applications** may be **imaged** by use of a **specialty transducer**.
- **Transducers** are **ultrasonic** **transducers** (a **transducer** on the **surface** of the **body**), but **imaging** **procedures** are often possible if a **transducer** can be **placed inside the body**.
- **For diagnostic, specialty transducers** (including **endovaginal**, **endorectal** and **transesophageal transducers**) are **commonly employed**.

**PHYSICS & SOUND**

**Understanding Sound Waves**

- **Sound** is a **mechanical wave** in which particles move, i.e., the molecules vibrate back and forth from a fixed position.
- **Sound** **travels** in a **straight line** and **sound waves** are **longitudinal waves**.
- **Sound waves** are **identified** by the following **acoustic variables**: **pressure**, **particle displacement**, **density** and **temperature**.
- **Diagnostic ultrasound**, **uses** i.e., **sound**, **travel**, **reflects** **from** **structures** in the **body**, **return** to the **transducer** and are **processed** into **images**.
- To understand exactly how that happens, let's review how **sound waves work**.

**Pressure**

- The **ratio** of **force** **acting** on a **surface object**:
- If there were no **force**, or **pressure**, **everything** **would** be in a **state of constant rest**.
- The **law of inertia** **explains** that a **body** in motion will **remain in motion**; likewise, a **body at rest** will **stay at rest** until **acted upon** by an **outside force**.
- **Up-and-down** **motion** **translates** human soft tissue out of its **state of rest**.

**FORMULA**

$$\text{Pressure} = \text{Force}/\text{Area} \quad \text{OR} \quad P = F/A$$

Units of measure: **Newton/meter<sup>2</sup>** or **Pa**

**Particle Displacement**

- The **distance** the **body** has **moved** after being **impacted** upon by a **force** (i.e., **how far** for the **particle** moved from its **equilibrium position**).

**Density**

- The **property** common to all **matter** and the **one property** that **makes** each type of **matter** **unique**.
- **Density** is **defined** as **mass per unit volume**, the **more** **mass** **confined** to a **given volume**, the **greater** the **density**.

For ultrasound, **density** is referred to as **mass density**, which can be **defined** as the **mass** of the **object** **divided** by its **volume**.

**FORMULA**

$$\text{Density} = \text{Mass}/\text{Volume} \quad \text{OR} \quad D = M/V$$

Units of measure: **kg/m<sup>3</sup>**, **g/cm<sup>3</sup>**

**Temperature**

- The **measurement** of **relative coolness** or **warmth** of an **object**.
- **Temperature** in **ultrasound** **varies** **inversely** with the **speed of sound** **varies** with the **temperature** of the **tissue** that is **being scanned**.

**Parameters of Sound Waves**

- The **seven** **parameters** of **sound waves** are **period**, **frequency**, **amplitude**, **power**, **intensity**, **acoustics**, **longitudinal**.
- **Period** and **frequency** **describe** the **speed** of the **wave**.
- **Amplitude**, **power** and **intensity** **describe** the **strength** of the **wave** (i.e., **Magnitude**); these **parameters** tend to be **directly related** when **intensity** **increases** as **its power** and **frequency**.
- **Period** is **Time** it **takes** for a **wave** to **vibrate** a **single cycle** (i.e., **from the start of one wave to the start of the next wave**).

**Wavelength**

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**Frequency**

- **Number** of **events** that **occur** in a **specific duration of time**.
- In **diagnostic ultrasound**, the **frequency** of a **wave** is **defined** as the **number of cycles occurring in one second**.
- **Frequency** is **important** in **diagnostic ultrasound** because it **affects penetration** and **image quality**.
- **Measured** in **units per second** or **Hz** (**Cycles/second** = **1 Hz**)
- **Frequency ranges** are **from** **20kHz** to **10 MHz** (**2 million to 10 million per second**)
- **Frequency determined by the sound source only**, not by the **tissue** **being scanned**.
- **Frequency is NOT adjustable** by the **ultrasonographer** (a **particular transducer**)

**Frequency Spectrum of Sound**

Information: **low** **less than 20 Hz**  
**midline** **between 20 Hz and 20 kHz**  
**ultrasound** **greater than 20 kHz**

**Wavelength**

Time: 1 sec.

**Amplitude**

- **Defined** as the "height" of the wave, it is the **difference** between the **minimum value** and the **maximum value** of the **波** (wave).
- **Amplitude** is **inversely proportional** to **density**, **density** (**g/cm<sup>3</sup>**), and **particle motion** (**any distance**).
- **Amplitude** is **determined** by the **sound source**, but **amplitude decreases** as it **travels** through the **body**.
- **Decrease in sound** **depends** on the **characteristics** of the **sound** and the **body tissue** the **wave** is **traveling** through.
- **The ultrasonographer** **can** **alter** the **initial amplitude** in an **ultrasound machine**.
- **Amplitude** is **measured** from the **middle value** to the **maximum value**.



## Synopsis

Our jam-packed 3-panel (6-page) guide is ideal for all sonography (ultrasound) students. This up-to-date guide features our customary easy-to-use format and informative, fluff-free style, with sections that cover all aspects of sonography—ranging from sound waves to image interpretation. Each section features “The Sonographer Knows” summary of critical points, set off graphically for easy reference.

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## Customer Reviews

It's a good review for physics portion of my classes, but I wish it had other topics for Sonography as well.

Nice review of topics covered in sonography in a handy form

It is a pretty good product. I find it accessible for quick reminders. I highly recommend it for student even a professional.

good

Nice quick chart review.

A waist if money. You can find same info on line. Nothing special.

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