
CONTENT SPECIFICATIONS FOR THE EXAMINATION IN SONOGRAPHY



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The purpose of the ARRT Examination in Sonography is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of staff sonographers at entry into the profession. To identify the knowledge and skills covered by the examination, the ARRT periodically conducts practice analysis studies involving a nationwide sample of sonographers¹. The results of the most recent practice analysis are reflected in this document. The complete task inventory, which serves as the basis for these content specifications, is available from our website www.arrt.org.

The table below presents the major content categories, along with the number and percentage of test questions appearing in each category. The remaining pages provide a detailed listing of topics addressed within each major content category.

This document is not intended to serve as a curriculum guide. Although certification programs and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address subject matter not included in these content specifications.

CONTENT CATEGORY	PERCENT OF TEST	NUMBER OF QUESTIONS ²
A. Patient Care	8%	20
B. Physical Principles of Ultrasound	32%	80
C. Sonographic Procedures		
I. Abdomen and Pelvis	22%	55
II. Gynecologic Structures	10%	25
III. Obstetrics	22%	55
IV. Other Sonographic Exams	<u>6%</u>	<u>15</u>
	100%	250

1. A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.
2. Each exam includes an additional 20 unscored (pilot) questions. On the pages that follow, the approximate number of test questions allocated to each content category appears in parentheses.

A. PATIENT CARE (20)

I. Legal and Ethical Principles (4-6)

- A. Confirmation of Exam Requisition
 - 1. verification of patient identification
 - 2. comparison of request to clinical indications
- B. Legal Issues
 - 1. common terminology (e.g., negligence, malpractice)
 - 2. legal doctrines (e.g., respondeat superior, res ipsa loquitur)
- C. Patient's Rights
 - 1. informed consent (written, oral, implied)
 - 2. confidentiality (HIPAA)
 - 3. Patient's Bill of Rights (e.g., privacy, access to information, health care proxy, research participation)
- D. ARRT Standard of Ethics

II. Patient Monitoring and Safety (5-7)

- A. Ultrasound Bioeffects and Safety
 - 1. pressure and intensity measurement
 - a. thermal index (soft tissue, cranium, bone)
 - b. mechanical index
 - 2. research on biological effects
 - 3. AIUM recommendations
- B. Routine Monitoring
 - 1. vital signs
 - 2. physical signs and symptoms
- C. Response to Common Emergencies
 - 1. allergic reactions (e.g., contrast, latex)
 - 2. cardiac/respiratory arrest (CPR)
 - 3. physical injury or trauma
 - 4. other medical disorders (e.g., seizures, diabetic reactions)
- D. Patient Transfer and Movement
 - 1. operator ergonomics
 - 2. body mechanics (balance, alignment, movement)
 - 3. patient transfer
- E. Assisting Patients with Medical Equipment
 - 1. infusion catheters and pumps
 - 2. pacemakers
 - 3. oxygen delivery systems
 - 4. other (e.g., nasogastric tubes, urinary catheters)

III. Interpersonal Communications (2-4)

- A. Modes of Communication
 - 1. verbal, written
 - 2. nonverbal (e.g., eye contact, touching)
- B. Challenges in Communication
 - 1. patient characteristics (e.g., cultural factors, physical or emotional status)
 - 2. strategies to improve understanding
- C. Patient Education
 - 1. explanation of procedure (e.g., risks, benefits)
 - 2. follow-up instructions
 - 3. referral to other services
- D. Medical Terminology

IV. Infection Control (5-7)

- A. Terminology and Basic Concepts
 - 1. types of asepsis
 - 2. sterile technique
 - 3. pathogens (e.g., fomites, vehicles, vectors)
 - 4. nosocomial infections
- B. Cycle of Infection
 - 1. pathogen
 - 2. source or reservoir of infection
 - 3. susceptible host
 - 4. method of transmission (contact, droplet, airborne, common vehicle, vectorborne)
- C. Standard Precautions (general patient contact)
 - 1. handwashing
 - 2. gloves, gowns
 - 3. masks
 - 4. medical asepsis / disinfection
- D. Additional or Transmission-Based Precautions (e.g., Hepatitis B, HIV, tuberculosis)
 - 1. airborne (e.g., negative ventilation)
 - 2. droplet (e.g., particulate mask)
 - 3. contact (e.g., gloves, gown)
- E. Disposal of Contaminated Materials
 - 1. linens
 - 2. needles
 - 3. patient supplies

B. PHYSICAL PRINCIPLES OF ULTRASOUND (80)

I. Generation of Signal (33-37)

- A. Transducers
 - 1. construction and properties
 - a. crystal thickness, wavelength
 - b. frequency spectrum, resonance
 - c. damping
 - 2. operation
 - a. focusing
 - b. beam diameter
 - c. piezoelectric effect
 - 3. types
 - 4. quality control tests
- B. Beam Configuration
 - 1. near and far field
 - 2. focal zone
 - 3. beam profile
- C. Pulse Characteristics
 - 1. pulse repetition frequency
 - 2. pulse repetition period
 - 3. spatial pulse length
 - 4. duty factor
 - 5. frequency
 - 6. resolution
 - a. axial
 - b. lateral
 - c. spatial
 - d. temporal
 - e. contrast
 - 7. quality control tests
- D. Technical Factors
 - 1. frequency, bandwidth, Q factor
 - 2. power
 - 3. pressure
 - 4. intensity
 - 5. amplitude
 - 6. quality control tests
- E. Modes
 - 1. B mode
 - 2. M mode
 - 3. Doppler
 - a. color
 - b. spectral
 - c. power/energy
 - d. aliasing

II. Propagation of Ultrasound through Tissue (18-22)

- A. Beam Interactions
 - 1. speed of sound in soft tissue
 - a. density
 - b. stiffness
 - 2. time and distance - range equation
 - 3. acoustic impedance
 - 4. normal and oblique incidence
 - 5. reflection
 - 6. transmitted/refracted waves
 - 7. intensity
 - 8. causes of artifacts
- B. Attenuation of Signal
 - 1. frequency dependence
 - 2. absorption
 - 3. scattering
- C. Biological Effects
 - 1. thermal
 - 2. cavitation
 - 3. output measures (e.g., MI, TIS, TIC, TIB, SPTA)
 - 4. ALARA

B. PHYSICAL PRINCIPLES OF ULTRASOUND cont.

III. Image Production (23-27)

- A. Technical Factors for Diagnostic Quality Images
 - 1. power
 - 2. focal zone
 - 3. depth
 - 4. compensation
- B. Detection and Display of Echoes
 - 1. transducer
 - 2. receiver
 - 3. amplitude
 - 4. dynamic range and compression
 - 5. analog-to-digital converter (ADC)
 - 6. digital-to-analog converter (DAC)
 - 7. brightness
 - 8. contrast
 - 9. compensation (e.g., gain, TGC, DGC)
 - 10. pre-processing
 - a. read magnification
 - b. harmonics
 - c. spatial compounding
 - d. panoramic imaging
 - e. 3-D imaging
 - 11. post-processing(e.g., smoothing, edge enhancement, filtering, write magnification)
- C. Display Modes
 - 1. real-time imaging
 - a. echogenicity of reflectors
 - b. echotextures
 - c. artifacts
 - 2. Doppler
 - a. angle of incidence
 - b. flow direction
 - c. flow velocity
- D. Appearance of Artifacts (reverberation, refraction, comet tail, mirror image, multipath, side lobes, grating lobes, ring down, shadowing, enhancement, speed, slice thickness, acoustic speckle)
- E. Evaluation and Selection of Representative Images
- F. Improvement of Suboptimal Images
- G. Recording Media
 - 1. analog
 - 2. digital
 - 3. PACS

C. SONOGRAPHIC PROCEDURES (150)

Type of Exam

Focus of Questions

I. Abdomen and Pelvis (52-58)

- A. Vasculature
 - 1. aorta and branches
 - 2. inferior vena cava (IVC) and confluences
 - 3. portal veins and confluences
- B. Biliary System
 - 1. gallbladder
 - 2. bile ducts (e.g., common biliary, extra-hepatic)
- C. Urinary Tract
 - 1. kidneys
 - 2. ureters
 - 3. bladder
- D. Spleen
- E. Pancreas
- F. Liver
- G. Other Organs and Tissue
 - 1. retroperitoneum
 - 2. lymphatic system
 - 3. adrenal glands
 - 4. gastrointestinal tract
 - 5. prostate
 - 6. peritoneal cavity
 - 7. lymphatic system

II. Gynecologic Structures (23-27)

- A. Uterus
 - 1. fundus
 - 2. body
 - 3. endocervix
 - 4. vagina
- B. Ovaries
- C. Adnexa
 - 1. fallopian tubes
 - 2. cul-de-sac
 - 3. vasculature

Exam Protocol (e.g., AIUM, ACR)

- clinical indications
- patient preparation
- patient positioning
- instrumentation (e.g., transducer, stand-off pads)
- technical factors
- evaluation and documentation of visualized anatomy
- optimizing image quality

Anatomy and Physiology

- normal
- abnormal
- measurements

Abnormalities

- pathology
- congenital anomalies
- lab values
- differential diagnosis

Special Technique/Procedures

- Doppler applications/blood flow characteristics
- interventional procedures

C. SONOGRAPHIC PROCEDURES cont.

Type of Exam

Focus of Questions

III. Obstetrics (52-58)

A. First Trimester Obstetrics

1. standard measurements (e.g., heart rate, CRL, MSD)
2. maternal anatomy (uterus, cervix, adnexa)
3. embryonic anatomy and physiology
 - a. fetal number
 - b. gestational age
 - c. decidual layer
 - d. amnion
 - e. chorion
 - f. yolk sac
 - g. embryonic pole
 - h. corpus luteum
 - i. cardiac activity
4. key abnormalities (e.g., anembryonic pregnancy, spontaneous abortion, ectopic pregnancy, embryonic demise, nuchal lucency)

B. Second and Third Trimester

1. standard measurements (e.g., BPD, FL)
2. maternal anatomy (uterus, cervix, adnexa)
3. fetal anatomy and physiology
 - a. fetal number
 - b. position, presentation, and lie
 - c. gestational age and weight
 - d. amniotic fluid volume
 - e. cord
 - f. placenta
 - g. cardiac activity
 - h. anatomic systems visualized (e.g., GI, CNS, cardiovascular)
4. chromosomal abnormalities (e.g., trisomies, triploidy)
5. genetic abnormalities (e.g., polycystic kidney disease, dwarfism)
6. infection (e.g., toxoplasma, CM virus, meconium peritonitis)
7. abnormal growth and development (e.g., club foot, atresia, anencephaly, renal agenesis, gastroschisis, VSD)
8. neoplasm (e.g., teratoma)

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C. SONOGRAPHIC PROCEDURES cont.

Type of Exam

- C. High Risk and Complicated Pregnancy
1. multiple gestations (chorionicity, amnionicity, twin-to-twin transfusion syndrome, conjoined)
 2. assisted reproduction / implantation
 3. amniocentesis
 4. fetal biophysical profile
 5. placenta (trophoblastic disease, previa, accreta, insufficiency, abruption, hematoma)
 6. amniotic fluid (polyhydramnios, oligohydramnios, PROM)
 7. hydrops (immune & non-immune)
 8. intrauterine growth restriction (symmetric & asymmetric)
 9. umbilical cord (2-vessel cord, knots, vasa previa, prolapse)
 10. cervical incompetence
 11. maternal disease and abnormality (e.g., diabetic, uterine anomaly)

IV. Other Sonographic Exams (14-16)

- A. Superficial Structures
1. abdominal wall
 2. scrotum and testes
 3. breasts
 4. superficial masses
 5. neck, thyroid, and parathyroid
 6. musculoskeletal
- B. Noncardiac Chest (pleural space)

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