MULTIPLE CHOICE

1. Historically, the development of ultrasound began shortly after:
   a. radio communication in World War I.
   b. sonar in World War II.
   c. nuclear testing in World War II.
   d. the launching of Sputnik.

   ANS: B
   World War II brought sonar equipment to the forefront for defense purposes. Ultrasound was influenced by the success of sonar equipment.

   PTS: 1 REF: p. 7
   OBJ: Detail a timeline for pioneers in the advancement of medical diagnostic ultrasound.
   TOP: Historical overview of sound theory and medical ultrasound

2. The early applications of obstetric ultrasound were initiated by:
   a. Joseph Holmes.
   b. Ian Donald.
   c. John Howry.
   d. William Fry.

   ANS: B
   The early obstetric compound scanner was built by Tom Brown and Dr. Ian Donald in Scotland in 1957.

   PTS: 1 REF: p. 7
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3. Visualization of the cardiac structures in the heart was discovered by:
   a. Joseph Holmes.
   b. Ian Donald.
   c. Hertz and Edler.
   d. George Ludwig.

   ANS: C
   In 1954, echocardiographic techniques were developed in Sweden by Drs. C.H. Hertz and I. Edler.

   PTS: 1 REF: p. 7
   OBJ: Detail a timeline for pioneers in the advancement of medical diagnostic ultrasound.
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4. Which one of the following statements about the role of sonographers is *false*?
   a. Sonographers perform ultrasound studies and gather diagnostic data independent of the physician.
   b. Sonographers must possess intellectual curiosity and perseverance.
   c. Sonographers must have a technical aptitude.
   d. Sonographers must be able to communicate on different levels.

   ANS: A
   A sonographer performs ultrasound studies gathering diagnostic data under *both* the direct and the indirect supervision of a physician. They also must assess clinical history and symptoms, interpret laboratory values, and understand other diagnostic examinations.

   PTS: 1 REF: p. 5 OBJ: Describe a career in ultrasound.
   TOP: Role of the sonographer

5. In soft tissues, the assumed propagation velocity is *(in meters per second)*:
   a. 1320.
   b. 1450.
   c. 1540.
   d. 1650.

   ANS: C
   In soft tissues, the assumed propagation velocity (speed) is 1540 meters per second.

   PTS: 1 REF: p. 9
   OBJ: Demonstrate an understanding of the basic principles and terminology of ultrasound.
   TOP: Introduction to basic ultrasound principles - Acoustics

6. Diagnostic ultrasound uses the frequencies of:
   a. 10 to 15 kHz.
   b. 1 to 20 kHz.
   c. 100 to 1000 Hz.
   d. 1 to 20 MHz.

   ANS: D
   Diagnostic application of ultrasound uses frequencies of 1 to 20 million cycles per second (1 to 20 MHz).

   PTS: 1 REF: p. 9
   OBJ: Demonstrate an understanding of the basic principles and terminology of ultrasound.
   TOP: Introduction to basic ultrasound principles - Acoustics

7. The device that converts energy from one form to another is called the:
   a. digitizer.
   b. transducer.
   c. scan converter.
   d. beam former.

   ANS: B
   Piezoelectric elements (transducers) convert electric energy into ultrasound energy and vice versa.

   PTS: 1 REF: p. 12
   OBJ: Demonstrate an understanding of the basic principles and terminology of ultrasound.
   TOP: Introduction to basic ultrasound principles - Acoustics

8. The angle of reflection is equal to the:
   a. acoustic impedance.
   b. angle of incidence.
   c. refraction.
   d. image resolution.

   ANS: B
   Angle of reflection is the angle between the reflected sound direction and a line perpendicular to the media boundary.

   PTS: 1 REF: p. 6
   OBJ: Demonstrate an understanding of the basic principles and terminology of ultrasound.
   TOP: Historical overview of sound theory and medical ultrasound

9. The display mode that shows time along the horizontal axis and depth along the vertical axis is:
   a. A mode.
   b. B mode.
   c. M-mode.
   d. real-time.

   ANS: C
   Motion mode (M-mode) displays the depth along the vertical axis versus the time along the horizontal axis.

   PTS: 1 REF: p. 15
   OBJ: Identify ultrasound instruments and discuss their uses.
   TOP: Pulse-echo display modes - M-mode

10. Which one of the following statements about the Doppler principle is *false*?
    a. Doppler refers to a change in frequency in which the motion of laminar or turbulent flow is detected within a vascular structure.
    b. The beam should be perpendicular to the flow.
    c. The Doppler shift is directly proportional to the velocity of the red blood cell.
    d. If the red blood cell moves away from the transducer, then the fall in frequency is directly proportional to the velocity and direction of the red blood cell movement.

    ANS: B
    The beam should be parallel to the flow to obtain the maximum velocity. The frequency of the Doppler shift is proportional to the cosine of the Doppler angle. At a 90-degree angle (perpendicular to flow), the Doppler shift is zero, regardless of the flow velocity.

    PTS: 1 REF: p. 18 |p. 19
    OBJ: Discuss three-dimensional and Doppler ultrasound.
    TOP: Doppler Ultrasound - Doppler Shift

11. The Fresnel zone is also called the:
    a. far field.
    b. focal point.
    c. near zone.
    d. Nyquist limit.

    ANS: C
    The Fresnel or near zone is the field closest to the transducer during the formation of the sound beam.

    PTS: 1 REF: p. 18
    OBJ: Demonstrate an understanding of the basic principles and terminology of ultrasound.
    TOP: System Controls for Image Optimization - Focal Zone

12. The higher the transducer frequency, the:
    a. shorter the wavelength.
    b. faster the frame rate.
    c. deeper the penetration depth.
    d. slower the frame rate.

    ANS: A
    The higher the frequency, the shorter the wavelength (inversely related).

    PTS: 1 REF: p. 18 | p. 22
    OBJ: Demonstrate an understanding of the basic principles and terminology of ultrasound.
    TOP: Introduction to basic ultrasound principles - Image resolution