

Part I. Answer these questions by marking the best answer among the choices given:

1. Motion of baby can best be viewed using ... ultrasound imaging.
 - a. 3D
 - b. 4D
 - c. M-mode
 - d. Doppler mode
2. If an ultrasound echo returns after $260\ \mu\text{s}$ from its transmission, the distance to reflection surface is ...
 - a. 1 cm
 - b. 5 cm
 - c. 10 cm
 - d. 20 cm
3. Basic idea of MRI relies on ...
 - a. Echo ranging
 - b. Magnetic resonance
 - c. Faster waves than light
 - d. Longer waves than light
4. The concerns about biosafety in using MRI come from ...
 - a. RF energy heat deposition
 - b. Effect of magnetic field on patient tissues
 - c. Using closed magnets
 - d. Having cars and trains close to the MRI location
5. The imaging application that needs the lowest x-ray energy is ...
 - a. Computed tomography
 - b. Bone imaging
 - c. Mammography
 - d. Angiography
6. X-rays are generated when fast moving electrons ...
 - a. Decelerate
 - b. Collide with target nuclei
 - c. Collide with each other
 - d. Heat up by the filament
7. Tomography aims to image ...
 - a. Overlapped view of body structures
 - b. Slice of the body
 - c. Projection of the body
 - d. Several plain x-ray images of the body
8. Main bioeffect of x-rays is ...
 - a. Heat deposition
 - b. Noise that affects hearing
 - c. Ionization leading to broken chemical and genetic bonds
 - d. Ablation of tissues

- *Assigned:* April 28, 2015
- *Deadline:* Sunday May 10, 2015
- *Submission:* Electronic form (PDF) to instructor's email address: ykadah@kau.edu.sa

Part II. Mark the following statement as either True (T) or False (F):

9. It is necessary to scan one line repeatedly from the B-mode image.
10. Ultrasound safety now is for the doctor to take care of based on ALARA principle.
11. The larger the MRI coil used, the better the quality of the image.
12. Cars and trains should be kept away from MRI systems to prevent them from being pulled by its magnetic field.
13. Having a video camera inside the MRI examination room near magnet will affect MRI image quality.
14. X-rays have less energy than light waves.
15. Fat attenuates x-rays more than blood.
16. X-ray dose accumulates in the body with time.

Part III. Answer ONLY TWO of the following question:

17. Compute the wavelength of ultrasound waves of frequency 5 MHz in tissues. (Hint: ultrasound speed in tissues is assumed to be 1540 m/s)
18. Calculate the percentages of reflected and transmitted ultrasound wave intensities for an interface with $z_1 = \frac{1}{2} z_2$. Repeat the same problem for $z_2 = \frac{1}{2} z_1$.
19. What is the resonance frequency of Hydrogen nuclei H^1 in a 1.5 Tesla MRI system?

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