Examination

1. The frequency of resonance depends on the local value of the magnetic field. Although the main magnetic field is designed to be quite uniform, additional magnetic fields can be temporarily superimposed on the main static field. This creates spatial variation in the net magnetic field, resulting in a (an) _______.
   a. electromagnetic coil
   b. magnetic field gradient
   c. resonant frequency
   d. Larmor frequency
   e. Fourier frequencies

2. Since three coordinates (x, y, and z) must be specified to localize a point in space, MR images require three separate gradient fields. In practice these fields are generated by _______________ that can be turned on and off rapidly.
   a. electromagnetic coils
   b. magnetic field gradients
   c. resonant frequencies
   d. Larmor frequencies
   e. Fourier frequencies

3. An MR image is the result of a complicated interplay between RF pulses and intermittently activated gradient fields, all of which are under computer control. Depending on the programming, a signal can be acquired from the whole volume simultaneously, which is considered
   a. a one dimensional acquisition.
   b. a two dimensional acquisition.
   c. a three dimensional acquisition
   d. a magnetic field acquisition.
   e. a Larmor frequency acquisition.

4. An MR image is the result of a complicated interplay between RF pulses and intermittently activated gradient fields, all of which are under computer control. Depending on the programming, a signal can be acquired from slices or planes within the volume, which is considered
   a. a one dimensional acquisition.
   b. a two dimensional acquisition.
   c. a three dimensional acquisition
   d. a magnetic field acquisition.
   e. a Larmor frequency acquisition.

5. Spatial resolution is determined by the number of frequency-encoded projections and phase-encoded projections for a given
   a. Larmor frequency
   b. repetition time
   c. magnetic field
   d. field-of-view
   e. x, y, or z-gradient
6. During readout, the spin echo signal is "sampled" a certain number of times. The number of times the spin echo is sampled is equal to the number of "projections" along the readout axis. The total period of time the echo is sampled is called the
   a. "bandwidth"
   b. "Larmor frequency"
   c. "echo sampling time"
   d. "field-of-view"
   e. "dwell time"

7. During readout, the spin echo signal is "sampled" a certain number of times. The number of times the spin echo is sampled is equal to the number of "projections" along the readout axis. The interval between samplings of the spin echo is called the
   a. "bandwidth"
   b. "Larmor frequency"
   c. "echo sampling time"
   d. "field-of-view"
   e. "dwell time"

8. The inverse of the dwell time is called the
   a. "bandwidth"
   b. "Larmor frequency"
   c. "echo sampling time"
   d. "field-of-view"
   e. "spatial resolution"

9. An increase in spatial resolution along the phase encode axis requires an increase in the number of phase-encoded projections. The only penalty for increasing spatial resolution along the readout axis is that there are fewer protons in the smaller voxels, which decreases the
   a. repetition time (TR)
   b. echo delay time (TE)
   c. free induction delay (FID)
   d. signal-to-noise ratio (S/N)
   e. radiofrequency time (RT)

10. Spatial resolution must be set prospectively. This is accomplished by specifying the size of the __________ and the field-of-view.
    a. dwell time (DT)
    b. Larmor frequency (LF)
    c. free induction delay (FID)
    d. echo sampling time (EST)
    e. acquisition matrix (Nᵣ x Nᵫ)

11. The _______ is a useful measure of the machine-determined ability to discriminate a lesion from its background.
    a. “resolving power”
    b. “Fourier Transform”
    c. “readout acquisition”
    d. “acquisition matrix”
    e. “excitation power”

12. Voxel volume is the product of the
    a. slice thickness and the magnet size
    b. two inplane pixel dimensions and the magnet size
    c. magnet size and the field-of-view
It should be noted that spatial resolution along the frequency encode (readout) axis can be improved in two ways. Which of the following methods listed below is one of the ways?

It should be noted that spatial resolution along the frequency encode (readout) axis can be improved in two ways. Which of the following methods listed below is one of the ways?

- increasing the magnet size and by sampling twice as fast
- doubling the strength of the readout gradient and sampling twice as long
- leaving the gradient unchanged and by sampling twice as fast
- increasing the magnet size and by sampling twice as long
- doubling the strength of the readout gradient and sampling twice as fast

If there is a high intrinsic S/N (due to higher fields or reduced bandwidth), then reducing the S/N to 25-35 percent of its previous value may be tolerated without a significant perceptual loss in image quality. However, at lower S/N levels, such losses not only result in a "grainy" appearance to a normal image but in loss of contrast-to-noise such that

- large lesions may be missed.
- fat containing lesions may be missed.
- calcified lesions may be missed.
- small lesions may be missed.
- blood containing lesions may be missed.

Although the majority of the MR signal comes from the hydrogen nuclei of water molecules, lipid protons in fatty tissues can also contribute. Fat and water protons do not resonate at exactly the same frequency. Fat protons resonate at a

- slightly lower frequency
- slightly higher frequency
- frequency that may be missed if the MR settings are not correct
- significantly higher frequency
- significantly lower frequency

For chemical shift artifacts, because the difference in frequencies (or the "chemical shift") is very small, it is expressed as

- "parts per thousand" or "ppt"
- "parts per billion" or "ppb"
- "parts per million" or "ppm"
- "parts per ten million" or "pptm"
- "parts per hundred million" or "pphm"

If a specific gradient is applied across an object of a given size, there will be a field difference across the object as well as a frequency difference. The highest frequency received is called the

- "Nyquist frequency"
- "Larmor frequency"
- "Fullerton frequency"
- "Holland frequency"
- "Bradley frequency"

A chemical shift artifact is most noticeable at interfaces between tissues containing different amounts of

- fat and bone.
- water and bone.
- protein and bone.
- protein and water.
- fat and water.
19. While chemical shift artifact is a potential problem in most parts of the body, it is generally not in the brain, although fatty marrow can shift over the brain, creating a
a. subdural hematoma
b. pseudo-subdural hematoma
c. pseudo-tumor
d. pseudo-subarachnoid hamartoma
e. pseudo-meningioma

20. When a chemical shift artifact is present and bothersome, it can be eliminated by
a. decreasing the strength of the gradient fields
b. increasing the signal-to-noise ratio
c. increasing the strength of the gradient fields
d. decreasing the signal-to-noise ratio
e. increasing the dwell time