Medical Equipment – Part 2 **SHEET #1**

1. Consider a 1.5T magnet with G_z=20 mT/m, the difference in larmor frequency between the magnet isocenter (z=0) and a position z=1 cm is equal to,
   a) 8.52 kHz b) 8.52 MHz c) 63.9 MHz

2. The axes in the rotating frame of reference differ from those in the laboratory frame of reference in that,
   a) Each of the transverse axes precess about their direction at the Larmor frequency
   b) The z-axis precesses at the Larmor frequency
   c) Both x and y axes rotate around the z-axis at the Larmor frequency

3. In order to change the flip angle of the RF pulse,
   a) Change the bandwidth of the RF pulse
   b) Change the amplitude of the RF pulse
   c) Change amplitude of the slice selection gradient

4. In order to change the slice profile,
   a) Change the envelope of the RF pulse at the same bandwidth
   b) Change the RF pulse amplitude
   c) Change the slice selection gradient

5. It is possible to reverse the action of magnetic field inhomogeneity dephasing in FID signals when using,
   a) Gradient echo sequence
   b) Spin-echo sequence
   c) Inversion recovery sequence

6. The signal after a perfect 180 degree RF pulse is expected to be,
   a) Zero b) T1-weighted c) T2* weighted

7. Comparing a gradient-echo and a spin-echo sequences with the same parameters (TR/TE, flip angle, etc.), the signal from gradient-echo is always,
   a) Smaller b) Larger c) Equal but opposite in phase

8. To measure T1, we usually use,
   a) Gradient echo pulse sequence
   b) Spin echo pulse sequence
   c) Inversion recovery pulse sequence

9. Magnetic resonance spectroscopy can be used for,
   a) Mapping concentration of different nuclei in the human body noninvasively
   b) Mapping concentration of different metabolites in the human body noninvasively
   c) Mapping magnetic field inhomogeneity in PPM scale inside the magnet

10. The T2-weighted MR image depends on,
    a) Only T2 values inside the body
    b) Only spin density inside the body
    c) Both spin density and T2 inside the body

11. A material that is chemically shifted from water by 1.7kHz has a different resonance frequency at 4T from that of water by approximately,
    a) 1 ppm. b) 10 ppm. c)100 ppm.

12. To null a tissue with T1=300 ms using inversion recovery, we should use a TI equal to approximately,
    a) 200 ms b) 300 ms c) 400 ms

13. The net magnetization refers to
    a) The remaining magnetization after T2* decay.
    b) The difference between spins pointing with B0 and those pointing against B0
    c) The magnetization in the transverse plane at equilibrium.

14. As the static magnetic field becomes higher, the MR signal from is expected to,
    a) Increase quadratically
    b) Decrease linearly
    c) Increase linearly

15. The tipped magnetization vector under the laboratory frame of reference appears,
    a) Precessing around z-axis at the Larmor frequency
    b) Stationary
    c) Rotating at the Larmor frequency.

16. In order to change the slice position of the RF pulse,
    a) Change the pulse modulation frequency
    b) Change the slice selection gradient position
    c) Change the position of the patient

17. In order to change the slice thickness,
    a) Change the slice amplitude
    b) Change the envelope at the same bandwidth
    c) Change the slice selection gradient

18. The rate at which the measured signal in the transverse plan disappears is a function of,
    a) T1 b) T2 c) T2*

19. The rate at which the inverted magnetization in inversion recovery sequences relaxes depends on,
    a) T1 b) T2 c) T2*

20. The signal decays fast in free induction decay because of,
    a) Spin-spin relaxation
    b) Spin dephasing
    c) Spin lattice relaxation

21. The signal at time TE in a spin echo pulse sequence depends on,
    a) T1 b) T2 c) T2*

22. To measure T1, we usually use,
    a) Inversion recovery pulse sequence
    b) Gradient echo pulse sequence

c) Spin echo pulse sequence

23. Magnetic fields in the Tesla range are used for MRI because,
a) they are easier to generate
b) they allow a stronger signal to be obtained
c) they provide better T1/T2 values
d) the existing magnets happen to be in that range
e) they provide lower noise

24. Rotating frame is preferred to lab frame because,
a) Rotating frame makes it easier to follow the motion of net magnetization
b) It provides a nicer polar representation instead of the usual Cartesian form
c) It makes it easier to image claustrophobic patients
d) It makes it faster to perform imaging
e) It reduces motion artifacts

25. Net magnetization can be observed only when,
a) it is in the rotating frame of reference
b) it is in the lab frame
c) it is in the equilibrium position
d) it is in the transverse plane
e) it is in the same direction as B0.

26. Equilibrium position of net magnetization can be reached after an RF pulse is followed by a delay that is equal to,
a) 5 T2 b) TR c) TE d) 5 T2* e) 5 T1

27. To control the slice thickness of an RF pulse, one can do the following:
a) Change the modulation of the RF pulse
b) Change the duration of the RF pulse
c) Change the bandwidth of the RF pulse
d) Change the amplitude of the RF pulse
f) Change the direction of the X and Y RF coils

28. A T2*-weighted pulse sequence can be,
a) A spin-echo sequence with long TR and long TE
b) A gradient echo sequence with short TR and short TE
c) A spin-echo sequence with short TR and long TE
d) A gradient sequence with long TR and long TE
e) A spin-echo sequence with long TR and short TE

29. A slice selection gradient of 5 mT/m if combined with an RF pulse of bandwidth of 1kHz will select a slice of thickness:
a) 1 cm b) 1 mm c) 2 mm d) 5 mm e) 8 mm