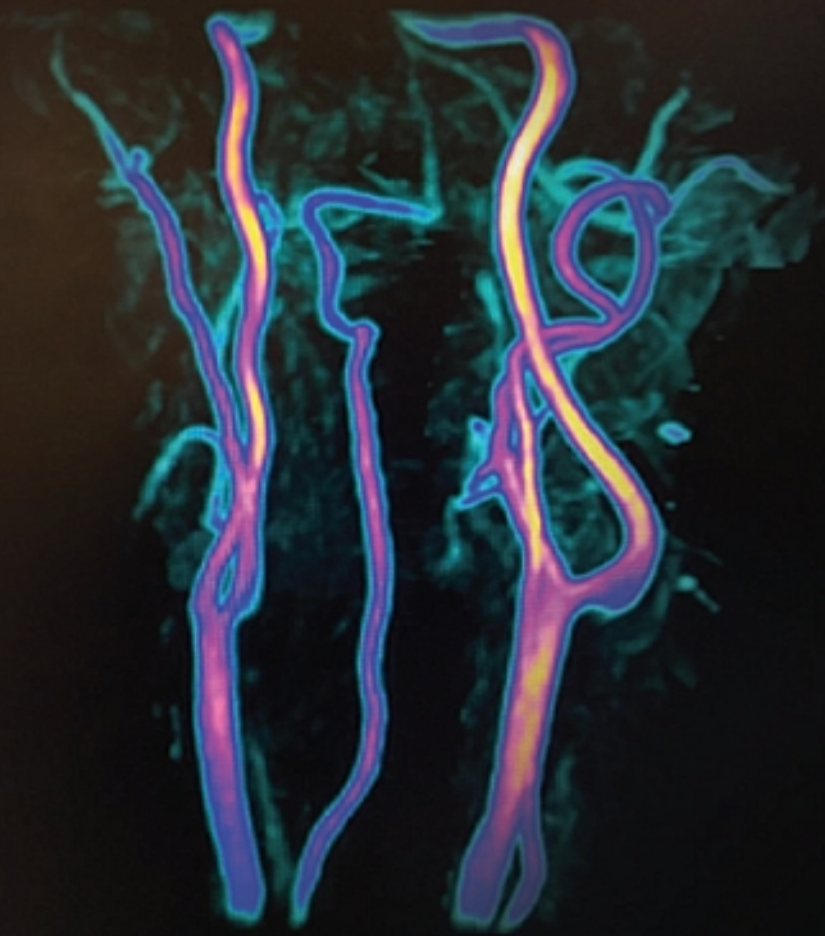
STEPHEN J. POWERS

MRI REGISTRY REVIEW

TECH TO TECH QUESTIONS AND ANSWERS



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MRI Registry Review

Tech to Tech Questions and Answers

Stephen J. Powers
South Coast Hospital Group
Fall River, MA, USA

WILEY Blackwell

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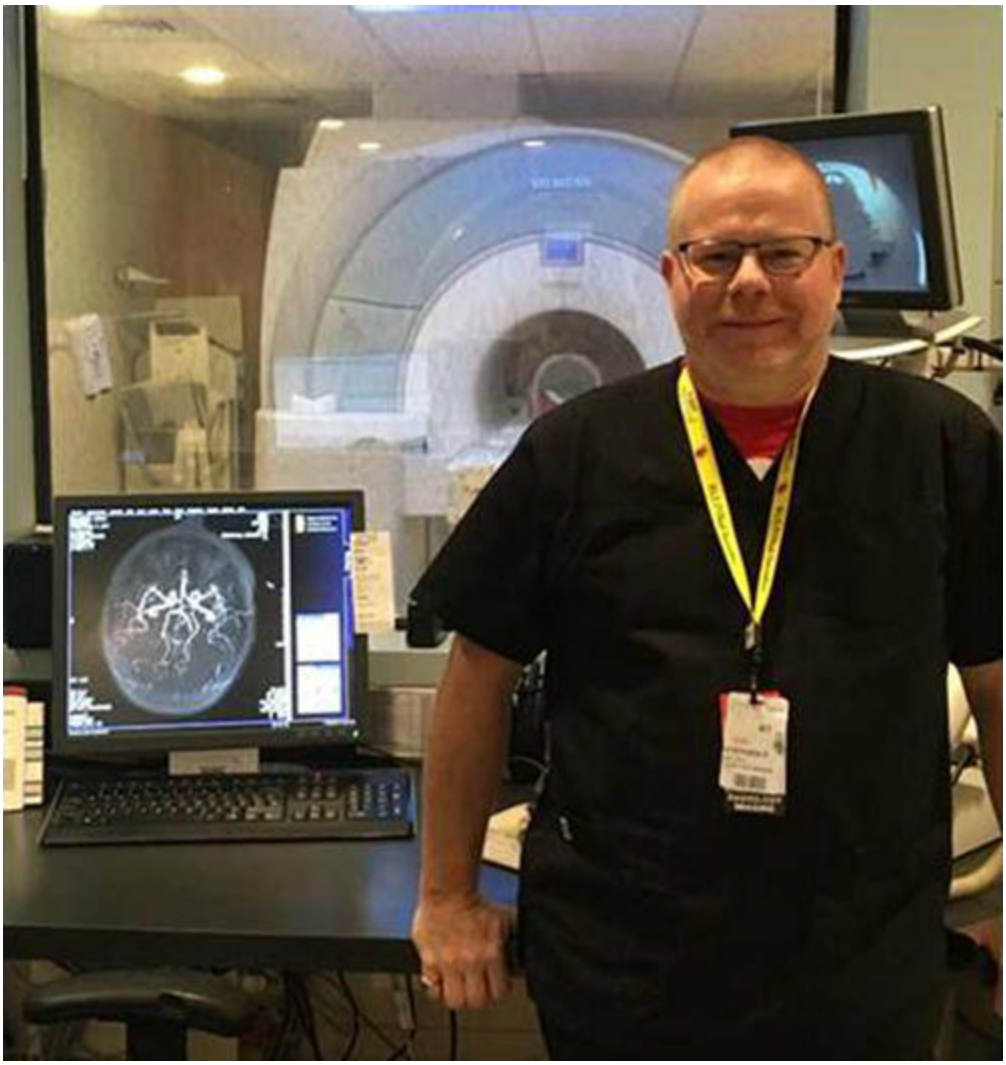
About the Author



Stephen J. Powers B.S.R.T. (R), (CT), (MR)

- Author of MRI Physics: Tech to Tech Explanations.
- Received Associate Degree: Radiologic Technology, Northeastern University, Boston, MA, 1981, and Bachelor of Science: Health and Social Sciences, Roger Williams University, Bristol, RI, 1996.

- Course Instructor: MR Physics, Cross-Sectional Anatomy and Pathology for the MR Certificate Program at Massasoit Community College, Brockton, MA, 1999–2014.
- Clinical MR Instructor for Mass. College of Pharmacy, 2010–2014.
- Former MR Applications Specialist: GE Health Care.
- Presently Staff MR Technologist for Southcoast Hospital Group.
- Married with two sons and living in Southeastern Massachusetts, USA.

Acknowledgments and Advice

This one’s for you Mom.

Again I have to say Thank you to my wonderful wife Suzanne for her patience and understanding while I wrote a Registry Review on the heels of MR Physics book.

Next, thank you to **Alicia Webb R.T.R.(MR)** my friend, and colleague for her artistic talents in drawing all the illustrations in this text book. You were a great help in drawing the different illustrations that are hard to find, image, or otherwise display. Thanks Allie!!

Rachelle (Pebbles), Thanks for my inside cover Picture. **You’re my favorite!!**

I also need to thank my past and present coworkers as well as my many former students for encouraging me to write this Registry Review book.

It only seemed natural that I should put together a registry review on the heels *MRI Physics: Tech to Tech Explanations*. While the advanced registry asks questions in no particular order, I have sectioned my questions by topic in a similar order to my physics book. I hope this mirroring will assist you in working on your weaknesses and not your strengths. For example, if you’re weak on pulse sequences or MRI Math, I want to have all those kinds of questions grouped together and to be able to easily find further answers and explanations in the corresponding chapters in *MRI Physics: Tech to Tech Explanations*. The various sections will state the corresponding chapter(s) in *MRI Physics: Tech to Tech Explanations* hopefully making your studying easier.

I wish you good luck and good fortune in your career as an MRI Technologist. Radiology has been very good to me. I hope it is as good to you and then some. Remember, **failing to prepare is prepping to fail.**

Peace,
Steve

Some Test-Taking Advice

I’d like to offer some suggestions, words of advice, and some FYI’s on how to give yourself the best chance to successfully pass the exam.

Sitting for this exam is a big and important next step in your imaging career. Stress will be the word of the day, week, month, or even year while you prep. Chill, it’s not that bad.

- **My first advice is: Scan baby Scan.** You learn a lot by doing. You know more than you think you do. You really do. Review anatomy while you scan. Look for artifacts. Studying while you scan is not just looking at questions during a sequence.
- **Practice answering questions.** Take time a few times a week to answer some questions. Correct them, the ones you got wrong, research the correct answer. This works on your weakness not your strengths.
- Try this: Answer 30 questions in 25 minutes. Train to work under some pressure. Not a lot, just some. Navy Seals train under pressure, we’re not Navy seals.
- Here is a technique I’ve learned over the years. Explain a concept or topic to somebody. When you verbalize something, you also learn. It makes things make sense. Things start to make more sense when you talk it out. Albert Einstein is credited with saying: “You don’t really understand something unless you can explain it to your Grandmother.” I love that saying, try it and see if it helps.

Now for Test Day

- Don’t schedule an appointment time for too early in the morning, if you oversleep, get stuck in traffic, and run late you’ll be even more stressed. It’s difficult to focus when stressed, you’ll make bad choices.
- Be 30 minutes early! You may lose your right to sit for the test if you are late.
- Get a good night sleep the night before.
- **Don’t stay up late cramming for the test**, you’ll end up getting confused, frustrated, even more stressed and worse yet, less confident.
- Have a good breakfast. Don’t be hungry. The brain works on sugar.
- *Raise your hand to ask bathroom breaks! Not more than 10 minutes long*.
- You will be photographed, and Palm printed.
- *Have two valid forms of I.D.*: *Driver’s license, Passport, or ARRT card*.
- You can’t bring anything in with you. Not even your pocketbook. They’ll give you a locker. Dress in layers as testing locations vary in temperature.
- You’ll need a calculator. One will be issued to you or use the one on the PC desktop.
- There is an 18-minute tutorial about the test. *You also need to acknowledge a Non-Disclosure agreement within two minutes after the tutorial*.
- *Then use the dry erase board!!!*
- On the dry erase board, jot notes/formulas or mnemonics before you start.
- You have 3.5 hours (210 minutes) to do 220 questions. That math is 1:00 minute per question. That may not sound like much but it really is. Many questions you’ll find easy and answer quickly giving more time as you go.
- Also don’t be in a rush to leave. Give yourself at least 5+ hours for the whole thing so you don’t have to rush. Answers made in haste well….
- Others questions will need some thought, so, DON’T DWELL ON A QUESTION FOR A LONG TIME. You must answer it, mark it as a go back, and continue. You can’t move on to question 22 until you answer question 21.
- **Practice answering questions at home**!!! Practice, Practice, Practice!!

Eliminating Possible Answers

- 20 of the 220 are pilot questions which don’t count for or against you. You don’t know which ones they are.
- There are four answers given for each question. 1 or 2 will probably be out-right wrong. Eliminate as many as possible to make the right choice.
- Look for answers that are ridiculous. If they’re too high/low or just plain can’t be correct, they’re probably wrong. Res Ipsa Loquitur applies.
- Look for grammatical clues. If the grammar doesn’t make sense on a fill in the blank or has a wrong syntax, it’s **probably** not the correct answer.
- Let one question answer another. One question may ask what the Gyromagnetic Ratio of Hydrogen is, while another one may have previously stated it while asking another question.
- **MR Terminology should be generic (not vendor specific).** They may make a cross vendor terminology chart available to you. It’s not fair to ask questions using Hitachi

terms if you have only scanned on GE or Siemens.

- Don’t get crazy trying to know every little aspect or detail of every concept involved in MRI. You are not working on your PhD. The test is designed to test your general knowledge in MRI, anatomy, and patient care.
- As for the previous statement, the exam is looking to see if you know basic anatomy, landmarks, and the consequences of your actions when changing scan parameters. For example, what happens to SNR if you decrease the FOV? or, if you increase the TR, what happens to the T1 weighting?
- When you are done with the exam, you’ll get a preliminary score. This is not your final official score. You’ll get that in about three weeks.
- *Raise your hand when you’re done*. You can’t just get up and leave. You need to be re-palm printed before being dismissed.

The next page has a chart taken directly from the ARRT website which shows you the breakdown.

Visit the ARRT website for complete information:

WWW.ARRT.ORG

What to Know

- You may ask what do I need to know? I could say, “Know-it-All,” but that’s a ridiculous answer and not possible. Key on the major topics.
- The next page has a breakdown of each Category and Subcategory. Note where the concentration of the questions is heaviest: **Image Production and Procedures**.
- **Patient Care and Safety**: Includes Medical-Legal, terminology. and Ethics.
- **Image Production**: Know the consequences of your actions.
- **Procedures**: Know your Anatomy.

ARRT Advanced MRI Exam Breakdown Displayed Below

Content category	Number of scored questions
• Patient care	18
Patient Interactions and Management (18)	
Safety	20
• *MRI Screening and Safety (20)*	
Image Production	105
• *Physical Principles of Image Formation (39)*	
• *Sequence Parameters and Options (36)*	
• *Data Acquisition, Processing, and Storage (30)*	

Content category	Number of scored questions
Procedures	57
▪ *Neurological (25)*	
▪ *Body (15)*	
▪ *Musculoskeletal (17)*	
Total	200

What's the Time Breakdown?

- The Tutorial = 18 minutes, and 2 minutes for the Non-disclosure agreement. 20 minutes total.
- A maximum of 3.5 hours to answer questions.
- Finally, 10 minutes for a post exam survey. Max. total time of four hours to complete exam.

MRI			
Scored Items	200	NDA Time (in min.)	2
Pilot Items	20	Test Time (in hours)	3.5
Total Items	220	Survey Time (in min.)	10
Tutorial Time (in min.)	18	Total Time (in hours)	4.0

Those charts, like I said, on the previous page are snapshots taken directly from the ARRT website. I'm betting you have seen them already. I show them as a reminder so you don't have to look them up again.

- For additional/more complete info go to WWW.ARRT.ORG

  What about if I've already taken the Advanced Certification exam and have to renew your certification?

  Then you are looking for CQR (Continuous Qualifications Requirement) information.
- Go to WWW.ARRT.ORG/CQR

Here's the skinny on the CQR.

- You have to take the SSA every 10 years for Credential earned **after 1 January 2011**.
- You need to complete CQR every 10 years for each eligible discipline. You have three years to complete the process. The ARRT notifies you when your window opens.
- Take the Structured Self-Assessment (SSA). **It is not a Pass/Fail test. There is no Fail.** You'll get CEU's assigned to you to improve on deficiencies based on your score.

This system makes you work on your weakness and not your strengths. That’s a good thing.

- Yes, most of those assigned CEU’s apply to your Biennium.

Cross-Vendor Terminology: Page 1

I include these Cross-Vendor Terminology lists only for your reference while studying. Don’t try to memorize/learn every single term.

General Electric	Siemens	Sequence/Term	Philips	Hitachi	Toshiba
SPIN ECHO	SPIN ECHO	Spin Echo	SPIN ECHO	SPIN ECHO	SPIN ECHO
GRE	GRE	Gradient Recalled Echo	FAST FIELD ECHO	FIELD ECHO	GE
SPGR	FLASH	Spoiled Gradient Echo	T1-FFE	RF SPOILED, SARGE, RSSG	FAST FE
GRASS	FISP	Coherent Gradient Echo	FFE	REPHASED SARGE	SSPF
SSFP	PSIF	Steady State Precession	T2-FFE	Time Reversed SARGE	None
FIESTA	True FISP	True FISP	BALANCE FE	Balanced SARGE, BASG	True SSFP
FIESTA-C	CISS	True FISP/Dual Excitation	None	Phase Balanced SARGE	None
None	DESS	Dual Echo Steady State	None	None	None
MERGE	MEDIC	Combined Multi Echo Gradient Echo	M-FFE	NONE	NONE
3D FGRE, 3D FAST SPGR	MP-RAGE	Ultrafast 3D Gradient Echo	3D-TFE	MP-RAGE	3DFAST-FE
FAST GRE, FAST SPGR	TURBO FLASH	Ultrafast Gradient Echo	TFE	RGE	FAST FE
LAVA	VIBE	3D Interpolated Gradient Echo	THRIVE	TIGRE	NONE
eDWI	REVEAL	Body Diffusion Weighted	DWIBS	NONE	VISION
SWAN	SWI	Susceptibility Weighting	VENOUS BOLD	NONE	NONE
TRICKS	TWIST	Dynamic MRA w/manipulated k-Space	4D-TRAK	NONE	NONE
VIBRANT	VIEWS	High Res. Breast imaging	BLISS	NONE	RADIANCE
INHANCE INFLOW IR	NATIVE TRUE FISP	Non Contrast Angio True FISP	TRANCE	VASC FSE	FBI, CIA

General Electric	Siemens	Sequence/Term	Philips	Hitachi	Toshiba
CARTIGRAM	MAP IT	Parametric T2 Mapping	NONE	NONE	NONE
IR, MPIR,	IR, TIR	Inversion Recovery	IR	IR	IR
STIR	STIR	Short TI	STIR	STIR	IR
FLAIR	TURBO FLAIR	Long TI	FLAIR	FLAIR	FASTFLAIR
FSE	TSE	Fast Spin Echo	TSE	FSE	FSE
SSFSE	HASTE	Single Shot Fast Spin Echo	SS-TSE	SSFSE	FASE
FR-FSE	RESTORE	Fast Spin Echo with Crusher pulse	DRIVE	DE-FSE	T2 PUL FSE
NONE	HYPERECHO	Hyper Echo	NONE	NONE	NONE
CUBE	SPACE	3D FSE	VISTA	NONE	NONE
ETL	TURBO FACTOR	Number of Echoes	TURBO FACTOR	SHOT FACTOR	ETL
ECHO SPACING	ECHO SPACING	Time between echoes	ECHO SPACING	INTER ECHO TIME (ITE)	ECHO SPACING
EPI	EPI	Echo Planar	EPI	EPI	EPI
ADC	ADC	Apparent Diffusion Coefficient Map	ADC	ADC MAP	ADC

The exam will be vendor neutral.

Cross Vendor Terminology Page 2

General Electric	Siemens		Philips	Hitachi
FIBERTRACK	DTI FIBER TRACK	DTI Tractography or Tractography	FIBERTRACK	NONE
NONE	TURBO GSE	Turbo Gradient Spine echo	GRASE	NONE
PROPELLER	BLADE	MOTION CORRECTION	MULIVANE	RADAR
BODY PROPELLER	BLADE		NONE	NONE
ASSET	m-SENSE	PARALLEL IMAGING	SENSE	RAPID
ARC	GRAPPA		NONE	NONE
2D/3D CSI	NONE	BRAIN SPECTRO	NONE	NONE
PROSE	3D CSI	PROSTATE	NONE	NONE
BREASE	GRACE	BREAST	NONE	NONE
FLOURO TRIGGER/SMART PREP	CARE BOLUS	CONTRAST BOLUS TIMING	BOLUS TRACK	FLUTE

General Electric	Siemens		Philips	Hitachi
		SCANNING PARAMETERS		
SPACING	DIST. FACTOR (% OF SLICE THICK)	DISTANCE BETWEEN SLICES	GAP	INTERVAL
PARTIAL FOV	RECTANGULAR FOV	RECTANGULAR FOV	RECTANGULAR FOV	RECTANGUL FOV
REC. B/W (in kHz)	BANDWIDTH (Hz/pixel)	BANDWIDTH	FAT/WATER SHIFT/PIXEL	BANDWIDTH
VARIABLE B/W	OPTIMIZED B/W	ADJUSTIBLE BANDWIDTH	OPTIMIZED B/W	VARIABLE B/
NPW	PHASE OVERSAMPLING	OVERSAMPLING/ANTI ALIASING	FOLD OVER SUPPRESSION	ANTI WRAP
FRACTIONAL NEX	HALF NEX	PARTIAL K SPACE FILLING	HALF SCAN	HALF SCAN
PARTIAL ECHO	ASYMETRIC ECHO	PARTIAL ECHO	PARTIAL ECHO	HALF ECHO
FLOW COMP	GMN (GRADIENT MOTION NULLING)	FLOW RELATED MOTION CORRECTION	FLAG/FLOW COMP	GR
RAMP PULSE	TONE	VARIABLE RF PULSE	TONE	SSP
MTC	MTC/MTS	MAGNETIZATION TRANSFER	MTC	MTC
FAT-SAT	FAT SAT	CHEMICAL PREP PULSE	SPIR	FAT SAT
WATER EXCITATION	WATER EXCITATION	WATER EXCITATION	PROSET	WATER EXCITATION
IDEAL	DIXON	DIXON TECHNIQUE	NONE	FATSEP
SAT PULSE	PRESAT	SPATIAL PREP PULSES	REST	PRE SAT
CONCATINATED SAT	TRAVELING SAT	MOVING SATURATION PULSE	TRAVEL REST	SEQUENTIAI SAT
PURE	NORMALIZE	MULTI CHANNEL COIL SIG. CORRECTION	CLEAR	NATURAL
ELLIPTICAL CENTRIC	ELLIPTICAL SCANNING	CENTRAL K-SPACE FILL (FOR MRA)	CENTRA	PEAKS

1
Patient Interactions and Management

This section will concentrate on the many aspects of Patient Care including: patient monitoring, safety, and some legal/ethical aspects of taking care of a patient. There are/will be approximately 30 questions on the subject of patient care. The breakdown is listed below.

- Ethics + Legal ≈ 4
- Screening/Safety ≈ 11
- Patient assessment/Monitoring ≈ 6
- Communication skills ≈ 5
- Infection control ≈ 4 (a.k.a. aseptic technique)

Answers will be provided at the end of each section. There will be some discussions/explanations as to the how's/why's/what's for select questions. Also, I will point out/explain why some of the choices were not the correct answer. This is another way of learning. Remember, it's ok to fail here at home so you don't fail at the testing site.

1. Informed consent consists of all the following except?

   A. Age and ability to understand statements ☐
   B. Right to stop and refuse further imaging treatment ☐
   C. Alternate imaging methods ☐
   D. Patients have all rights to bring suit ☐

2. What is the FDA safe Gauss line limit?

A. 0.5 Gauss ☐
B. 5 Gauss ☐
C. 50 Gauss ☐
D. 5 T ☐

3. A systolic blood pressure of below 100 is a sign of?

A. Hypertension ☐
B. Hyperglycemia ☐
C. Cardiac arrest ☐
D. Hypotension ☐

4. What is libel?

A. Chance for a mistake ☐
B. A true statement made to purposely defame a person’s reputation ☐
C. A false statement made to purposely defame a person’s reputation ☐
D. A new kind of oral contrast ☐

5. Res Ipsa Loquitur means “It speaks for itself”. It implies that:

A. There was a breach in duty harm resulting ☐
B. The results are in question ☐
C. A principle that the occurrence of an accident implies that negligence caused the incident ☐
D. A and C ☐

6. What are the signs of cardiac arrest?

A. No pulse ☐

B. Cyanosis ☐
C. Patient is unresponsive ☐
D. All the above ☐

7. What are the contraindications for administering gadolinium?

A. There are none ☐
B. C.O.P.D ☐
C. Renal impairment ☐
D. Allergy to iodine ☐

8. What condition requires the patient to wear a mask?

A. There are none ☐
B. C.O.P.D ☐
C. Tuberculosis ☐
D. Pneumonia ☐

9. A patient on contact precautions requires technologists to wear?

A. HazMat suits ☐
B. Gown, gloves, and mask ☐
C. Gown and gloves ☐
D. Eye protection ☐

10. True or False: All patients require at least visual and verbal monitoring.

11. What is the preferred method to R/O metallic foreign body?

A. Hi resolution CT ☐
B. P/A and lateral X-ray views of the orbits ☐

C. Panorex views of the orbits ☐

D. Visual exam by the radiologist ☐

12. What is the accepted practice for administering gadolinium to a nursing mother?

A. Gadolinium is not excreted thru breast milk ☐

B. Pump and dump for the next 24 hours ☐

C. Don’t give them gadolinium ☐

D. All the above ☐

13. What instrument is used to take a patient blood pressure?

A. Laryngoscope ☐

B. Pulse Ox ☐

C. Sphygmomanometer ☐

D. Osteotome ☐

14. What is a potential effect is emesis?

A. Hives ☐

B. Hypertension ☐

C. Jaundice ☐

D. Dehydration ☐

15. A patient on respiratory precautions requires technologists to wear?

A. HazMat suits ☐

B. Gown, gloves, and mask ☐

C. Gown and gloves ☐

D. Eye protection ☐

16. The localization light can possibly cause eye damage. True or False?

17. Why does the I.V. bag need to be above the heart at all times?

A. Avoid infection	☐
B. Avoid blood back flow	☐
C. Avoid air bubbles	☐
D. B and C	☐

18. Which is not a concern during a quench?

A. Combustion	☐
B. Frost bite	☐
C. Room pressure increases	☐
D. Asphyxiation	☐

19. Who needs to be monitored?

A. Only sedated patients	☐
B. The elderly	☐
C. Pediatric	☐
D. All patients	☐

20. RF irradiation is expressed as SAR. SAR is measured in:

A. kilowatts/min	☐
B. W/g	☐
C. W/kg	☐
D. What’s/kg	☐

21. A patient with high BUN and creatinine values may have what condition?

A. Renal infection ☐
B. Renal artery stenosis ☐
C. Renal insufficiency ☐
D. Renal cysts ☐

22. True or False: Gadolinium will not cross a non-intact BBB.

23. Several factors influence the patient's ability to dissipate heat including all but:

A. Ambient room temperature ☐
B. Coil type ☐
C. Altitude ☐
D. RF amplitude ☐

24. Which sequence has the highest amount of time-varying magnetic fields?

A. Gradient recalled ☐
B. Spin echo ☐
C. Fast spin echo ☐
D. Echo planar ☐

25. Which sequence has the highest amount of RF applied to the patient?

A. Turbo spin echo ☐
B. Gradient echo ☐
C. Spin echo ☐
D. MRA ☐

26. Individuals with pacemakers should remain outside the _____ fringe field line?

A. 5.0 Gauss ☐
B. 50 Gauss ☐
C. 2.0 Gauss ☐
D. 0.5 Gauss ☐

27. FDA limits for heating due to RF is limited to:

A. 0.5 °C in normal mode ☐
B. 1.0 °C in first mode ☐
C. 1.5 °C in either mode ☐
D. A and B ☐

28. True or False: Resistive magnets should be quenched if a heavy object is drawn into it.

29. The attractive force that a ferrous object will see 5 feet from the bore depends on:

A. Size of the object ☐
B. Field strength ☐
C. Metallic properties of object ☐
D. All the above ☐

30. 5 Gauss is also known as:

A. 0.5 mT ☐
B. 5 mT ☐
C. They don’t convert ☐
D. 0.05 mT ☐

31. True or False: Objects closest to isocenter are more likely to heat from RF exposure.

32. Who obtains informed consent?

A. R.N ☐
B. R.T.R ☐
C. M.D. or D.O. ☐
D. Unit Secretary ☐

33. Why do sedated patient need to be N.P.O.?

A. Diabetes ☐
B. Risk of vomiting ☐
C. Airway managing ☐
D. B and C ☐

34. Common signs and symptoms of an allergic reaction are:

A. Emesis ☐
B. Dyspnea ☐
C. Urticaria ☐
D. All the above ☐

35. True or False: When imaging for a Wilms tumor, you would be scanning a child’s abdomen.

36. What is the noise level (dB) limit inside of the bore?

A. 14.0 dB ☐
B. There is none ☐
C. 100 dB ☐
D. 140 dB ☐

37. True or False: Objects away from isocenter see the highest amount of magnetic field change during a sequence.

38. Photo phosphenes can be induced during an MRI by _____.

39. In the event of a quench, the scan room should be evacuated to avoid _____.

- A. RF burns ☐
- B. Hearing loss ☐
- C. Frost bite and asphyxiation ☐
- D. B and C ☐

40. A slight increase in body temperature is a common occurrence when exposed to _____.

- A. The static magnetic field ☐
- B. Gradients ☐
- C. RF ☐
- D. All the above ☐

41. The amount of RF deposited into the body is depends on _____.

- A. Strength of the RF field ☐
- B. TE ☐
- C. Flip angle ☐
- D. A and C ☐

42. DTPA, a chelating agent, is used to _____.

- A. Prevent rapid excretion by the kidneys ☐
- B. Allow permeability through the BBB ☐
- C. Decrease toxicity of gadolinium ☐
- D. All the above ☐

43. Extra caution when giving gadolinium is advised in cases of:

- A. Decreased renal function ☐
- B. Known allergy to gadolinium ☐
- C. History of sickle cell anemia ☐
- D. All of these ☐

44. Normal enhancing structures outside of the BBB include all but the _____.

- A. Dural sinuses ☐
- B. Pituitary stalk and gland ☐
- C. Basal ganglia ☐
- D. Choroid plexus ☐

45. _____ is the most common cryogen used to maintain superconductivity.

- A. Oxygen ☐
- B. Hydrogen ☐
- C. Helium ☐
- D. Nitrogen ☐

46. At isocenter, the unit of magnetic strength is measured in _____ while outside of the scanner it is measured in _____.

- A. Gauss, Watts ☐
- B. Gauss, Tesla ☐
- C. Tesla, Gauss ☐
- D. Watts, MHz ☐

47. True or False: A tympanoplasty is a contraindication for the patient to have an MRI.

48. The SAR limits are:

- A. 4 W/kg Body and 3 W/kg Head ☐
- B. 3 W/kg Body and 4 W/kg Head ☐
- C. 4 kW/kg Body and 3 kW/kg Head ☐
- D. 40 W/kg Body and 30 W/kg Head ☐

49. Sudden and rapid loss of superconductivity due to the release of cryogens describes a _____.

- A. Quatrain ☐
- B. Quadrilateral ☐
- C. Quadrant ☐
- D. Quench ☐

50. How often should imaging coils be inspected for safety?

- A. Monthly ☐
- B. Quarterly ☐
- C. Annually ☐
- D. Every time you use them ☐

51. Copper lining in the walls, windows, floor, and door designed to keep RF out of the scan room is called the _____?

- A. Shielding ☐
- B. Faraday cage ☐
- C. Faraday induction ☐
- D. Passive shielding ☐

52. Two typical sites to check a pulse is the _____ and the _____.

- A. Wrist and Carotids ☐
- B. Femoral and Pedal ☐
- C. Temporal and Wrist ☐
- D. with a B/P cuff and Doppler ☐

53. The hematocrit is an indicator of what?

- A. Volume of red blood cells ☐
- B. Hemoglobin level ☐
- C. Sickle cell anemia ☐
- D. Liver function ☐

54. What anatomical area would you image for bowel and bladder dysfunction?

- A. Brachial plexus ☐
- B. Thoraco-lumbar junction ☐
- C. Sacral plexus ☐
- D. Cerebral pontine angle ☐

55. When imaging, what part of the patient’s EKG trace can increase/elevate?

- A. P wave ☐
- B. T wave ☐
- C. Q wave ☐
- D. QRS complex ☐

56. What condition is the result of decreased blood supply to bone?

- A. Septic necrosis ☐

B. Hemangioma ☐
C. Avascular necrosis ☐
D. Hemangioma ☐

57. Islet cells are found in which organ?

A. Kidney ☐
B. Pancreas ☐
C. Liver ☐
D. Conus medullaris ☐

58. What part of the femur is most often affected by avascular necrosis?

A. Femoral head ☐
B. Lesser trochanter ☐
C. Surgical neck ☐
D. Mid shaft ☐

59. What imaging plane best demonstrates the Achilles tendon?

A. Axial ☐
B. Coronal ☐
C. Sagittal ☐

60. The prostate is located where in relation to the bladder?

A. Anterior and superior ☐
B. Inferior and anterior ☐
C. Inferior and posterior ☐
D. Superior and posterior ☐

61. What sequence is most sensitive to M.S. plaques?

- A. GRE ☐
- B. FSE/TSE ☐
- C. T2 FLAIR ☐
- D. T1 FLAIR ☐

62. What blood vessel has the greatest pressure?

- A. Aortic arch ☐
- B. Pulmonary veins ☐
- C. Renal arteries ☐
- D. Coronary artery ☐

63. T wave elevation during an MRI is an example of _____.

- A. Patient anxiety ☐
- B. Magneto-hemodynamic effect ☐
- C. Equipment failure ☐
- D. Loose skin contacts ☐

64. The sciatic nerve originates from the _____?

- A. Sacral plexus ☐
- B. L2/3 ☐
- C. Upper thigh ☐
- D. Medulla oblongata ☐

65. What is the first branch off the abdominal aorta?

- A. Renal ☐
- B. Celiac ☐
- C. Superior mesenteric ☐