

3rd Year Medical Equipment II Class Review Questions
May 2007

I. Solve the following problem by marking the best choice among the multiple answers given [1/2 point each]:

1. Extracorporeal shock-wave lithotripsy is ...
 - a. invasive
 - b. Minimally invasive
 - c. entirely noninvasive (*)
2. The positioning of the patient in lithotripsy is done using ...
 - a. Biplane x-ray system (*)
 - b. Ultrasound imaging
 - c. Magnetic resonance imaging
3. In spark gap lithotripters, a high voltage of ... is applied to the spark gap to cause a discharge.
 - a. 1000 V
 - b. 10000 V
 - c. 20000 V (*)
4. The goal of lithotripsy is to reduce the kidney stone to small fragments of size ... to pass through the urinary tract.
 - a. 0.1-0.2 mm
 - b. 0.5-1 mm
 - c. 1-2 mm (*)
5. The patient sits in a water bath during lithotripsy because ...
 - a. Water cools off the heat produced during the operation
 - b. Water is a good medium for shock wave propagation (*)
 - c. To make it simpler to image the progress of the operation.
6. Ellipsoidal reflector is used in lithotripsy for ...
 - a. Focusing the shock wave (*)
 - b. Generating the shock wave.
 - c. Protecting the patient from dangerous radiation.
7. Isolation amplifiers are devices that ...
 - a. amplify the protection barrier in a system
 - b. Isolate wanted components in the input signal from noise.
 - c. break the ohmic continuity of electric signals between its input and output (*)
8. The methods used to achieve electrical isolation do NOT include ...
 - a. Capacitors
 - b. Inductors (*)
 - c. Optical isolators
9. The electrical power supply isolation can only be done using ...
 - a. Capacitors
 - b. Inductors
 - c. Transformers (*)
10. Double-insulated equipment include ...

- a. Two layers of insulation material between the exposed electrical conductors, chassis, and outer case (*)
 - b. Two power supply isolation stages.
 - c. One power supply and one signal isolation stages.
11. In hemodialysis units, transmembrane pressure controls:
- a. Ultrafiltration rate (*)
 - b. Dialysate flow rate
 - c. Blood flow rate
12. Dialysate temperature control must keep the temperature within the following tolerance from the set value:
- a. $\pm 0.3^\circ$
 - b. $\pm 0.5^\circ$
 - c. $\pm 1^\circ$ (*)
13. Removal of waste metabolites from the body in hemodialysis uses the following mechanism:
- a. Diffusion (*)
 - b. Perfusion
 - c. Ultrafiltration

II. Mark the following statement as either True (T) or False (F) [1/2 point each]:

- 14. Up to 2000 shock waves may be necessary in lithotripsy. (T)
- 15. After lithotripsy, most patients are able to resume full activity within one day. (F)
- 16. Ultrasound imaging can be used to break up kidney stones. (F)
- 17. The lithotripsy apparatus is complex and expensive to purchase and operate. (T)
- 18. Power supply isolation is sufficient for patient safety in medical instrumentation. (F)
- 19. Any transformer can be utilized to achieve electrical isolation. (F)
- 20. AC-powered low-voltage electronic circuit based medical equipment requires electrical isolation. (T)
- 21. The occurrence of a single fault in the dialysis system may allow the dialysate temperature used in the dialysis process to be above 43° . (F)
- 22. The acceptable tolerance in dialysate temperature control is 10%. (F)
- 23. The acceptable tolerance in dialysate transmembrane pressure control is 10%. (T)
- 24. It is not possible to directly measure the ultrafiltration rate using a flowmeter (T)
- 25. The acceptable tolerance in dialysate temperature control is 10% (F)
- 26. The acceptable tolerance in dialysate transmembrane pressure control is 10% (T)
- 27. Spiral CT can be used to image 3D slabs (T)
- 28. CT can be used effectively near air or bone tissue interfaces (T)
- 29. It is possible to indirectly measure the ultrafiltration rate using flowmeters (T)
- 30. A single fault in hemodialysis system components must not result in dialysate temperature higher than 42° to be in contact with the blood. (T)

- 31. Air bubble detectors in dialysis machines can detect air bubbles that are larger than 1 mL (T)
- 32. Source to detector position in CT may vary during scanning (F)
- 33. The resultant image from CT is a map of attenuations represented by unique CT numbers (T)

Part III. Solve the following Problems

34. In designing an ultrafiltration rate estimation unit using flowmeters, if the desired accuracy of the ultrafiltration rate calculation is $\pm 5\%$ and given the nominal dialysate flow rate of 1L/min and a desired ultrafiltration rate of 1L/hr, then the accuracy of the flowmeters to be used must be at least: ...

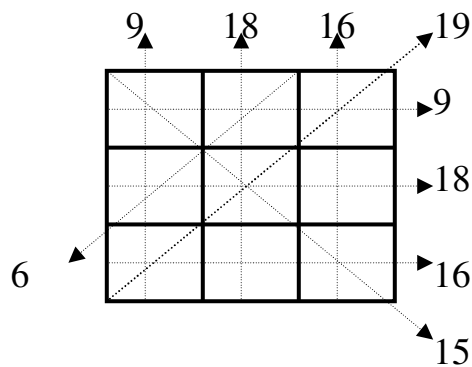
(sol= 0.04166%)

35. At 100 keV, if the known attenuation values for a particular tissue type and water are: 0.18 and 0.1707 respectively, then, the CT number of that tissue is: ... (sol= 54.5)

36. For a device to be considered an “ultrafiltration control” system, it must function with an overall accuracy of $\pm 5\%$ of the selected ultrafiltration rate or ± 100 mL/hr, whichever is greater. Determine the value of the overall accuracy when the selected ultrafiltration rate is 1 L/hr. (sol= ± 50 mL/hr)

. In designing an ultrafiltration rate estimation unit using flow meters, if the accuracy of the flowmeter technology available is $\pm 0.02\%$ and given the nominal dialysate flow rate of 1L/min and a desired ultrafiltration rate of 1L/hr, then the accuracy of the ultrafiltration rate estimation will be: ... (sol=2.4%)

PART IV. Solve the following reconstruction problem using ART (5 points)



1 3 5
3 9 6
5 6 5