

**3<sup>rd</sup> Year Medical Equipment II Class Review Questions**  
May 2007

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**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  $43^\circ$ . (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  $42^\circ$  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: ...

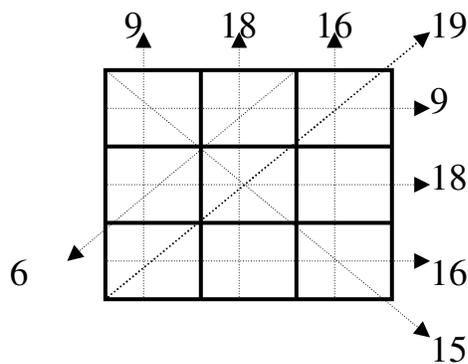
(sol= 0.04166%)

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  $\pm 100$  mL/hr, whichever is greater. Determine the value of the overall accuracy when the selected ultrafiltration rate is 1 L/hr. (sol=  $\pm 50$  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