

# MDCB PRACTICE TEST

## MDCB PRACTICE TEST 1

### STATEMENT OF PURPOSE AND USAGE

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1. Which type of DVH shows the volume receiving a dose within a specified dose range?
  - A. integral
  - B. cumulative
  - C. organ
  - D. differential

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2. Which one of the following DVH results for a pancreatic treatment plan of conventional fractionation meets QUANTEC recommended dose tolerances?
  - A. 75% of the left kidney will receive 30 Gy.
  - B. 50% of the right kidney will receive 40 Gy.
  - C. 50% of the liver will receive 42 Gy.
  - D. 25% of the stomach will receive 45 Gy.
  
3. Which of the following is TRUE regarding clinical electron beams?
  - A. High energy electrons lose energy at a rate of approximately 2 MeV per cm of water or soft tissue.
  - B. The depth of the 80% isodose occurs at approximately 1/4 of the electron energy in MeV.
  - C. The depth of the 90% isodose occurs at approximately 1/3 of the electron energy in MeV.
  - D. The practical range of electrons (in cm of water) is approximately 2 times the energy in MeV.
  
4. What factors are instrumental in determining the dose uniformity in equally weighted parallel opposed beams?
  - A. beam energy, tissue inhomogeneity and patient thickness
  - B. beam energy, patient thickness and tissue maximum ratio
  - C. beam flatness, patient thickness and collimator scatter
  - D. patient thickness, inhomogeneity and collimator scatter
  
5. Which of the following computer algorithms can most accurately account for the dose calculation uncertainty in the interface region between inhomogeneous materials for photon calculations?
  - A. convolution/superposition
  - B. Monte Carlo method
  - C. pencil beam method
  - D. ray tracing
  
6. An IMRT technique in which the patient is treated slice by slice by intensity-modulated beams in a manner analogous to CT imaging is called:
  - A. step-and-shoot therapy.
  - B. dynamic MLC therapy.
  - C. helical LINAC.
  - D. MRI-guided therapy.
  
7. Which one of the following is the best thermal neutron absorber?
  - A. stainless steel

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- B. lead
  - C. boronated polyethylene
  - D. concrete
8. Relative skin dose from a megavoltage photon beam is increased by which of the following?
- A. decreasing the beam output
  - B. decreasing the field size
  - C. increasing the thickness bolus material used
  - D. increasing the blocking tray to skin distance
9. The risk of symptomatic radiation pneumonitis is:
- A. increased if the GTV is located in the upper portion of the lung.
  - B. increased if certain chemotherapy agents are used.
  - C. unrelated to fraction size.
  - D. unrelated to lung volume

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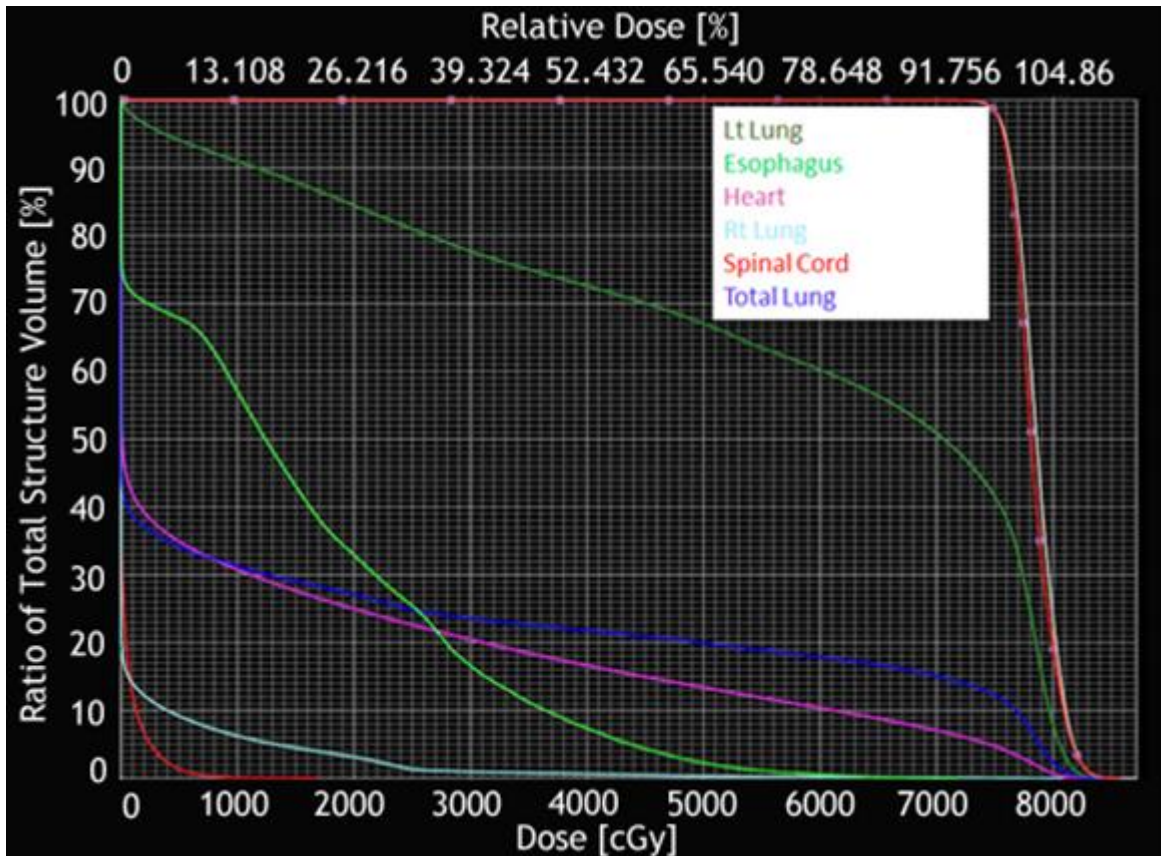


10.

Arrow #2 points to which of the following?

- A. adrenal gland
- A. pancreas
- B. stomach
- C. transverse colon

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11.

According to the DVH shown, what is the V20 of the total lung?

- A. 17%
- B. 27%
- C. 37%
- D. cannot be determined from this graph

12. DVHs can confirm which of the following?

- A. The location of target volume.
- B. The normal tissue tolerances are respected.
- C. The clinical target volume (CTV) is adequately drawn.
- D. The dose calculation grid is adequately set.

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13. When comparing identical (IMRT) treatment plans, one delivered with sliding window and the other delivered with step-and-shoot, the sliding window treatment will most likely have which of the following?

total monitor units	total treatment time
A. higher	longer
B. lower	longer
C. higher	shorter
D. lower	shorter

14. What will result if a photon field abuts an electron field at the skin surface?

- A. photon side hot spot, electron side cold spot
- B. photon side cold spot, electron side hot spot
- C. uniform dose distribution
- D. hot spot on both sides at the skin surface



15. In the image shown, arrow #1 points to the:

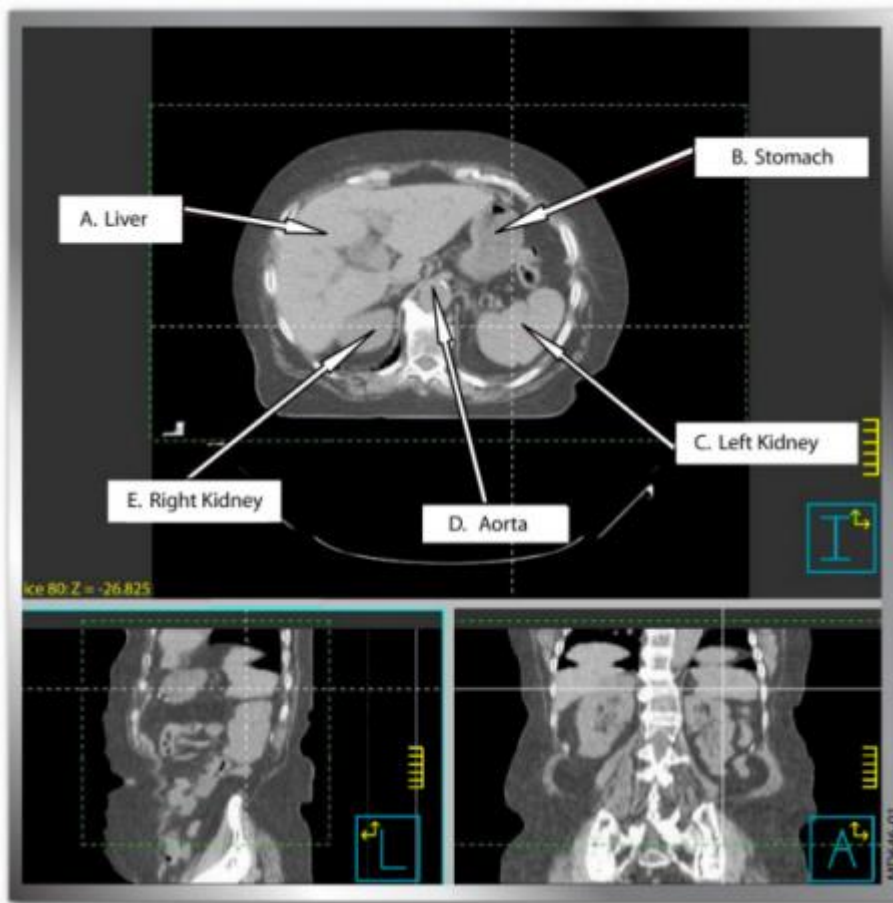
- A. sphenoid sinus.
- B. maxillary sinus.
- C. external auditory canal.
- D. mastoid air cells.

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16. Isocentric, parallel opposed oblique fields with unequal depths may result in:
- A. the maximum dose for a particular field decreasing as the isocenter dose increases.
  - B. the use of two different field sizes to offset the oblique incidence.
  - C. a plan with isodose lines that are similar to a plan with equal depths and unequally weighted beams.
  - D. a plan with isodose lines that are similar to a plan with equal depths and equally weighted beams.
17. What can cause increased skin dose in IMRT for prostate cancer?
- A. prone position
  - B. wedge under knees- a support device
  - C. use of high-energy photons
  - D. carbon fiber couch

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18. In the CT scan below, which organ is INCORRECTLY labeled?



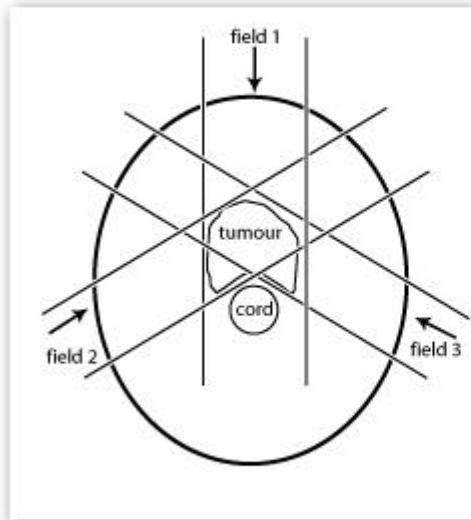
- A. liver
  - B. stomach
  - C. left kidney
  - D. aorta
19. Which of the following processes best explains how a radiation beam is delivered during step-and-shoot IMRT?
- A. Radiation is only delivered while the MLC is stopped.
  - B. The radiation beam is left on during the entire delivery sequence.
  - C. All MLC leaves move in one direction only.
  - D. All MLC leaves move in two opposite directions.



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20. Refer to the figure below.

**This diagram shows the field arrangements in the treatment of nasopharynx.**



Distribution List:

- 1) 105% 90%
- 2) 105% 90%
- 3) 105% 90%
- 4) 105% 90% 105%
- 5) 105% 90%

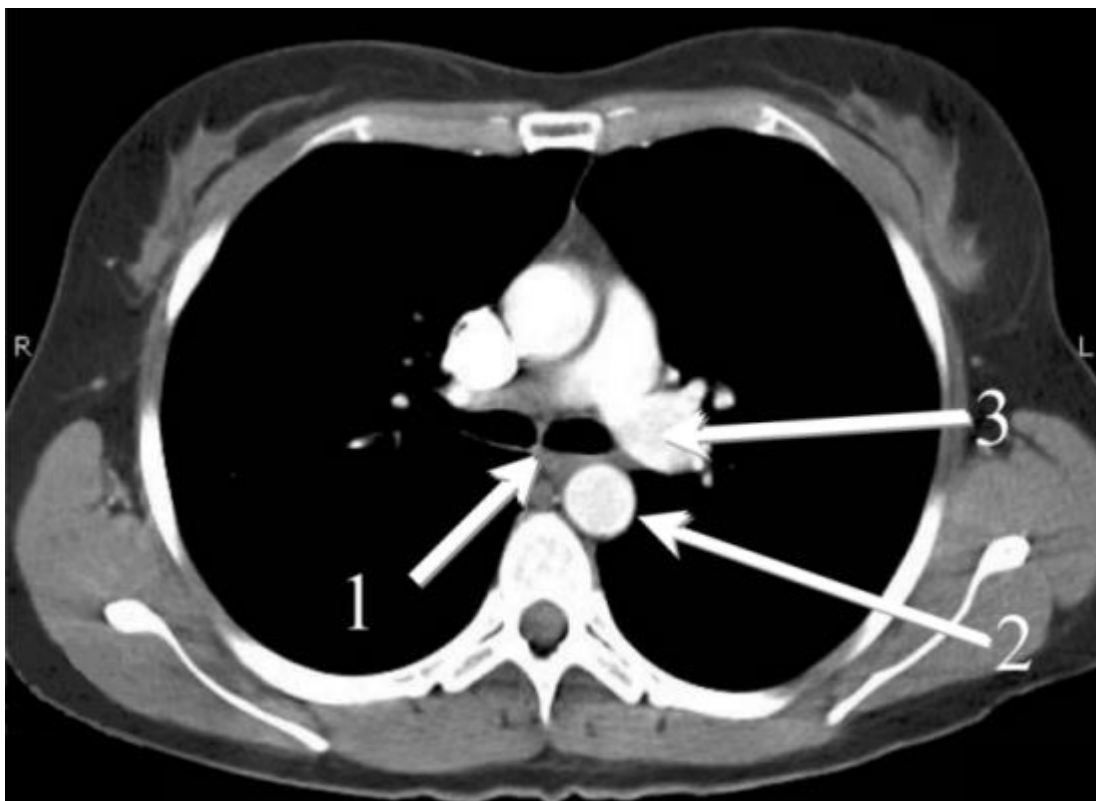
Note: All fields have the same weighting.

Which diagram shown in the distribution list is correct for the 90% and 105%?

- A. #1 (diamond)
- B. #2 (hat)
- C. #3 (hexagon)
- D. #5 (bowtie)

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21.



Arrow #2 points to which of the following?

- A. descending thoracic aorta
  - B. carina
  - C. pulmonary trunk
  - D. left pulmonary artery
22. Characteristics of MLC, in current medical LINACs, include which of the following:
- A. accommodates all field sizes.
  - B. "scalloped" isodose curves in the penumbra region.
  - C. ability to conform to all possible field shapes.
  - D. inability to verify leaf shapes.
23. Which of the following can be determined from the V20 obtained from a DVH for both lungs?
- A. volume of both lungs receiving 20% of the total dose
  - B. volume of both lungs receiving 20 gy
  - C. dose to 20 cubic centimeters (cc) of total lung volume
  - D. dose to 20% of total lung volume

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24. To eliminate the divergence into the lung of both fields when planning an intact breast treatment using isocentric medial and lateral opposed fields, it would be necessary to:
- A. adjust the angle according to the angle of the wedges used.
  - B. match the posterior diverging beam edges.
  - C. match the anterior diverging beam edges.
  - D. match the central axis of both beams.
25. Physical penumbra width is defined as the lateral distance between which two isodose curves at the level of  $d_{\max}$ ?
- A. 10% and 50%
  - B. 10% and 90%
  - C. 20% and 50%
  - D. 20% and 80%
26. Two adjacent electron fields are to be used to treat a post-mastectomy chestwall. The radiation oncologist has expressed concern that a cold spot at the surface be avoided. Appropriate techniques include which of the following?
- A. Match the fields at the  $D_{\max}$  depth of the electron fields.
  - B. Match the fields with a 0.5 cm overlap.
  - C. Move the junction several times during the treatment course.
  - D. Match the fields with a gap of 0.5 cm at the skin surface.
27. The minimum nominal distance a tissue compensator should be placed from the skin surface without affecting the skin sparing effect is:
- A. 5.0 cm.
  - B. 10.0 cm.
  - C. 20.0 cm.
  - D. 25.0 cm.
28. When treating with electrons typical X-ray contamination dose to a patient ranges from approximately:
- A. 0.1% to 0.4%
  - B. 0.5% to 5%
  - C. 6% to 9%
  - D. 10% to 12%
29. Rounded ends on the leaves of a multi-leaf collimator are used to:
- A. enhance field shaping potential.
  - B. achieve a constant tissue-air ratio.
  - C. reduce interleaf leakage.
  - D. achieve a constant penumbra as field size varies.

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### **ANSWER KEY 1**

1. D
2. D
3. A
4. A
5. B
6. C
7. C
8. C
9. B
10. C
11. B
12. B
13. C
14. A
15. B
16. C
17. D
18. C
19. A
20. C
21. A
22. B
23. B
24. B
25. D
26. C
27. C
28. B
29. D

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## MDCB PRACTICE TEST 2

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1. Which of the following statements regarding geometric penumbra is TRUE?
  - A. Penumbra size is not dependent on the source size.
  - B. The penumbra decreases as block-to-skin distance increases, all other factors being equal.
  - C. The penumbra increases as the distance from the source increases, all other factors being equal.
  - D. In general, the penumbra will become sharper on an accelerator as the collimator setting is increased.

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2. A 12 MeV electron beam displays which of the following characteristics?
  - A. Depth of the therapeutic range is ~ 3.0 cm.
  - B. Depth of 80% isodose is ~ 4.0 cm
  - C. Depth of the practical range is < 5 cm
  - D. Depth of maximum dose is on the skin.
3. Which calculation method independently calculates the primary and the scattered components of dose at a point in the calculation volume?
  - A. Convolution superposition
  - B. Ray tracing
  - C. Manchester
  - D. Monte Carlo
4. The effective field size for a 10x10 field size, with 30% blocked is approximately how many cm<sup>2</sup>?
  - A. 5.5
  - B. 6.5
  - C. 7.5
  - D. 8.5
5. Which of the following statements is CORRECT regarding the concept of equivalent squares in dose calculation?
  - A. A rectangular field is equivalent to a square field if they have the same Area/Perimeter ratio.
  - B. A rectangular photon field has the same output and percentage depth dose (PDD) as a square field of the same area.
  - C. Standard equivalent square table values for rectangular fields are applied to electron output and percentage depth dose data.
  - D. The concept of equivalent squares is primarily useful in the determination of beam flatness

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6. A patient is treated with a 6 MV photon beam,  $12.5 \times 12.5 \text{ cm}^2$  at 110 cm SAD to a 9.0 cm depth. The machine is calibrated to deliver 1.0 cGy per monitor unit at  $d_{\text{max}}$  for a  $10 \times 10 \text{ cm}^2$  field at 100SSD. The number of monitor units required to deliver 150 cGy at the isocenter is:

### TISSUE MAXIMUM RATIO (TMR) FOR 6 MV PHOTONS

Depth (cm)	$10 \times 10 \text{ cm}^2$	$12 \times 12 \text{ cm}^2$	$14 \times 14 \text{ cm}^2$
1.5	1.000	1.000	1.000
9.0	0.810	0.818	0.824

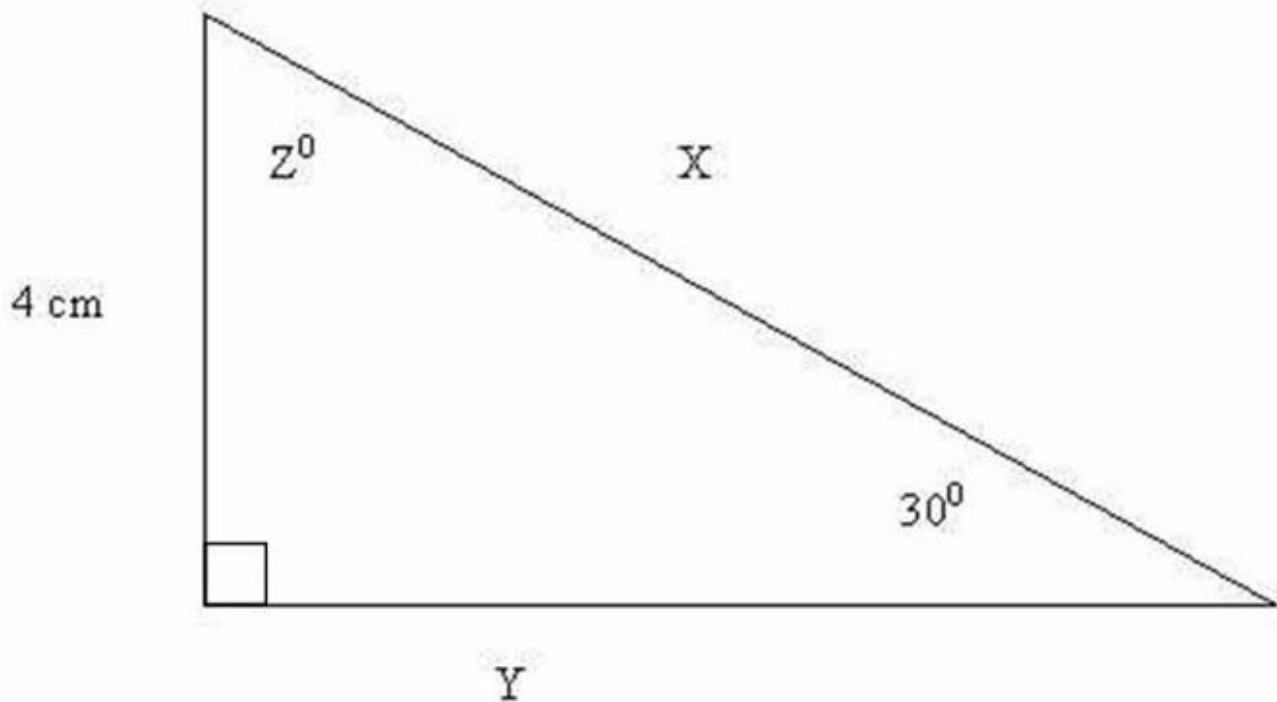
- A. 183.  
B. 210.  
C. 247.  
D. 221.
7. Computerized MU calculations for delivery of the prescribed dose to a point near a block need special care for which of the following reasons?
- A. The calculation point may be projected under the block.  
B. Electron scatter from the block is not accounted by the computer.  
C. The block reduces scatter in the field.  
D. A steep dose gradient exists near the block.
8. The dose rate at a patient's mid-plane is found to be 250 cGy/min at 100 cm SAD. A protocol for hemi-body irradiation stipulates that the dose rate must be no more than 100 cGy/min. At what minimum SAD must the patient be treated?
- A. 120 cm  
B. 145 cm  
C. 158 cm  
D. 182 cm
9. If 150 cGy is delivered at a depth of 7.0 cm at 100 cm SSD and the percent depth dose (PDD) is 65%, the dose at  $d_{\text{max}}$  is \_\_\_\_\_ cGy.
- A. 98  
B. 195  
C. 215  
D. 231

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10. When an isocentric technique is used in place of an SSD technique (both beams treated at 100SSD) to deliver the same midpoint dose to a patient with two parallel opposed fields, the:
- A. relative skin dose is decreased
  - B. number of monitor units for both fields is increased
  - C. field size at the patient's surface must be increased to treat the same volume of tissue
  - D. ratio of maximum dose to midpoint dose is increased
11. An attenuation coefficient for a 6 MV beam is  $0.94 \text{ cm}^{-1}$ . The thickness of a two (2) half value layer (HVL) block is:
- A. 1.36 cm
  - B. 1.47 cm
  - C. 2.72 cm
  - D. 2.83 cm



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12. Calculate the dose to the spinal cord at 6 cm depth from a 100cm SSD PA treatment that has a tumor dose of 90 cGy defined at a depth of 12 cm.

$$\text{PDD (fs, 1.5cm)} = 100$$

$$\text{PDD (fs, 6cm)} = 82.1$$

$$\text{PDD (fs, 12cm)} = 64.1$$

- A. 58 cGy  
B. 74 cGy  
C. 115 cGy  
D. 121 cGy
13. Calculate the Given Dose of a 100cm SSD treatment with a tumor dose of 60 cGy prescribed to a depth of 11 cm.

$$\text{PDD (fs, 1.5cm)} = 100$$

$$\text{PDD (fs, 5.5cm)} = 81.1$$

$$\text{PDD (fs, 11cm)} = 67.1$$

$$\text{PDD (fs, 12.5cm)} = 62.5$$

- A. 73 cGy  
B. 74 cGy  
C. 89 cGy  
D. 110 cGy

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14. A patient is treated for lung cancer using AP/PA parallel-opposed, equally weighted fields at 180 cGy/day. An anterior 30- degree wedge is used daily, with a factor of 0.617. This factor was accidentally left out of the calculation for the first 4 days of treatment, but the wedge was used for treatment. What total dose did the patient receive after 4 days of treatment?
- A. 484 cGy
  - B. 544 cGy
  - C. 582 cGy
  - D. 944 cGy
15. A radioactive material is assayed at noon and measures 10.0 mCi. The following day at noon, the radioactive material is assayed and measures 8.0 mCi. What is the half-life of the material?
- A. 60.0 hours
  - B. 65.4 hours
  - C. 74.5 hours
  - D. 3.7 days
16. Which radioisotope has the longest half-life?
- A. Ra-226
  - B. I - 192
  - C. Ce-137
  - D. I-125
17. For a total peripheral dose of 12,500 cGy from an Iodine-125 (I-125) seed implant of the prostate, the initial peripheral dose rate is:
- A. 6.0 cGy/hr.
  - B. 8.7 cGy/hr.
  - C. 10.0 cGy/hr.
  - D. 12.5 cGy/hr.
18. The number of atoms decaying per second is expressed in terms of their:
- A. decay constant.
  - B. mean life.
  - C. gamma constant.
  - D. activity.

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19. A film of an implant is taken with the source at 100 cm and the film at 120 cm. The length of a 2 cm long source on the film is:
- A. 1.6 cm.
  - B. 1.8 cm.
  - C. 2.2 cm.
  - D. 2.4 cm.
20. Based on NCRP recommendations, which of the following is a guideline regarding pregnancy and radiation exposure?
- A. The fetus can be considered as an occupationally exposed individual.
  - B. The exposure to the fetus should not exceed 50 mSv for the entire gestational period.
  - C. The exposure to the fetus should not exceed 5 mSv in any one month.
  - D. Pregnant medical radiation workers can be considered occupationally exposed individuals.
21. The dose response model applied in establishing dose limits for occupational workers is the:
- A. linear threshold model.
  - B. linear-quadratic threshold model.
  - C. linear no-threshold model.
  - D. chi-square non-threshold model.
22. Which of the following statements is/are TRUE concerning radiation warning signs?
- A. Only the term "Danger" may be used in "Radiation Areas".
  - B. The terms "Caution" or "Danger" may be used in "High Radiation Areas".
  - C. Only the term "Danger" may be used in "Very High Radiation Areas".
  - D. Only the color scheme of magenta or purple on yellow is acceptable for use on warning signs.
23. The installation of any new treatment planning system requires the acceptance testing of which of the following?
- A. processing speed
  - B. software
  - C. power consumption
  - D. memory capacity
24. At what frequency should treatment chart checks be accomplished for each patient?
- A. daily
  - B. weekly
  - C. monthly
  - D. randomly

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25. According to AAPM TG Report #142 standards, what is the minimum frequency for checking the door interlock?
- A. daily
  - B. weekly
  - C. monthly
  - D. quarterly
26. What is the standard file format for network communication that allows handling, storing, transferring and printing of medical imaging data?
- A. DICOM
  - B. CITRIX
  - C. BUS
  - D. WAN

## **MDCB PRACTICE TEST**

### **ANSWER KEY 2**

1. C
2. B
3. A
4. D
5. A
6. D
7. D
8. C
9. D
10. D
11. C
12. C
13. C
14. C
15. C
16. A
17. A
18. D
19. D
20. D
21. C
22. B
23. B
24. B
25. A
26. A

# MDCB PRACTICE TEST

## MDCB PRACTICE TEST 3

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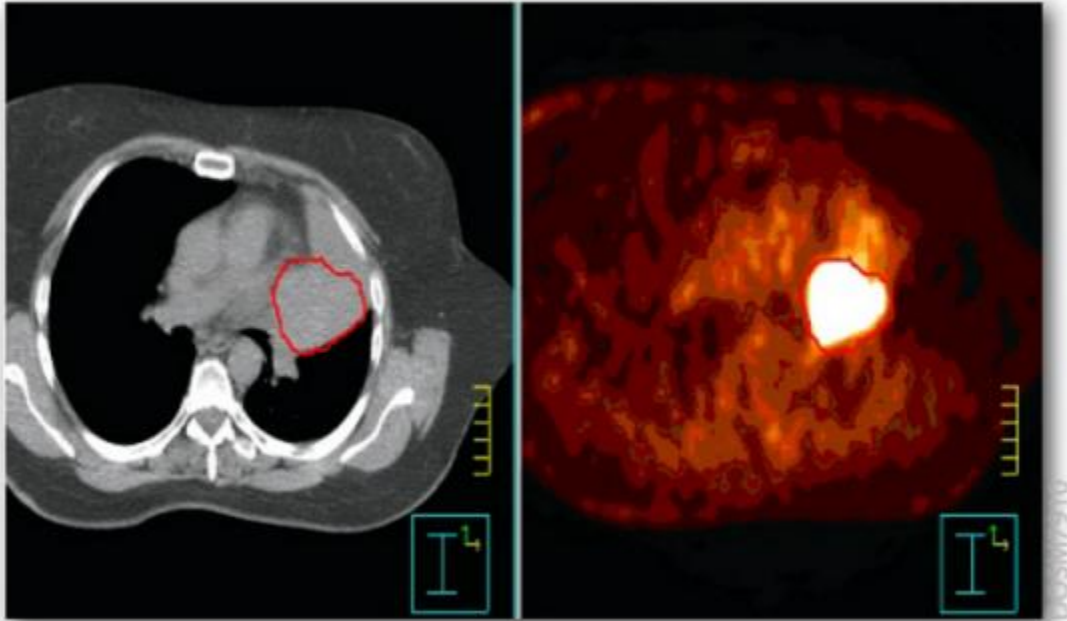
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1. The force which holds the nucleus together is:
  - A. strong nuclear.
  - B. electromagnetic.
  - C. weak nuclear.
  - D. gravitational.
  
2. Which type of interaction is taking place when there is X-ray contamination while treating a patient with electrons due to interaction with the collimator and the patient?
  - A. photoelectric
  - B. Compton
  - C. pair production
  - D. *bremsstrahlung*

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3. The energy required to remove an inner shell electron from its orbit is called:
  - A. ionization energy
  - B. binding energy
  - C. kinetic energy
  - D. transition energy
  
4. Which of the following is a potential late toxicity of pre-operative radiotherapy in the treatment of rectal carcinoma?
  - A. small-bowel obstruction.
  - B. polycythemia.
  - C. lymphedema
  - D. bladder perforation.
  
5. A customized bite block may be used to do which of the following?
  - A. secure a reproducible jaw position.
  - B. reduce respiration motion of the oral cavity.
  - C. allow port film registration.
  - D. preserve dental integrity during treatment.
  
6. Which of the following is TRUE about prostate gland movement during a course of external beam radiotherapy?
  - A. It can be decreased by treating the patient with a full or empty bladder.
  - B. It can be eliminated by the use of thermoplastic body molds.
  - C. It can be monitored by electronic portal imaging and implanted prostate markers.
  - D. It is greatest in the transverse dimension.

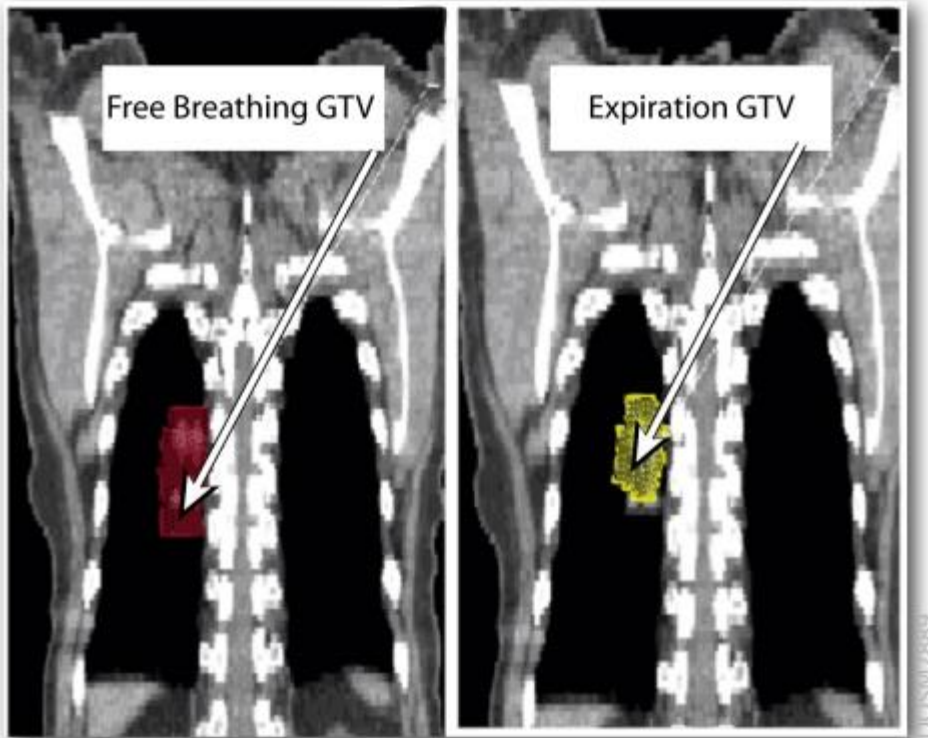
## MDCB PRACTICE TEST



7. Comparing CT and MRI images, the:
- A. CT and MRI define the same volume.
  - B. MRI defines a larger volume.
  - C. CT and MRI volumes cannot be compared.
  - D. CT defines a larger volume.
8. In which of the following sites is respiratory gating not advantageous?
- A. lung
  - B. breast
  - C. liver
  - D. nasopharynx
9. Adaptive radiation therapy is best described as a(n):
- A. approach to conform high dose to the target volume and minimize dose to sensitive structures.
  - B. precise form of radiation therapy used to treat intracranial tumors.
  - C. technique where the radiation beams are shaped to match the tumor.
  - D. process where the treatment plan can be modified, depending on changes in the geometry of the tumor and/or patient.



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10. The change in tumor shape in the associated figures is due to:
- A. different slice thickness for CT.
  - B. tumor motion.
  - C. patient positioning.
  - D. cardiac cycling.
11. According to the RTOG Breast Cancer Atlas, the contour of the Breast CTV should include the:
- A. apparent glandular tissue and axillary lymph node regions.
  - B. apparent glandular tissue and tissue outlined by conventional anatomic markers.
  - C. lumpectomy GTV, including the surgical scar.
  - D. lumpectomy CTV + 1 cm margin.
12. In IMRT, the smallest beam element is called a:
- A. beamlet.
  - B. voxel.
  - C. pixel.
  - D. spot.

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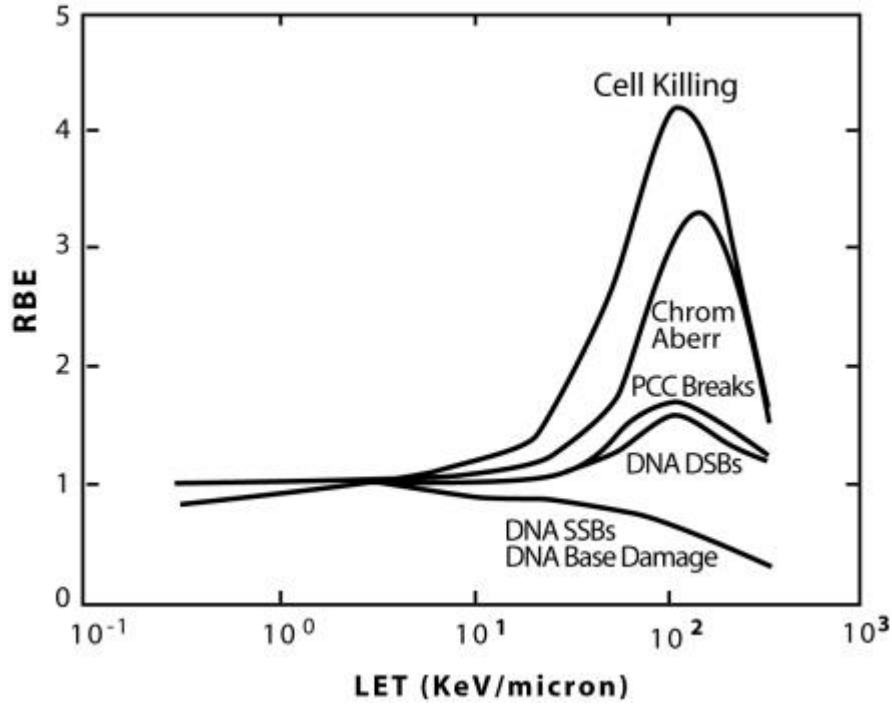
13. Which of the following treatment techniques is likely to be associated with the greatest integral dose to normal tissue?
- A. single direct portal
  - B. 2 opposed portals
  - C. 4-field 3-dimensional conformal
  - D. 8-field IMRT
14. The surface dose for 6 MeV electron beam, based on a 10x10 cm<sup>2</sup> field size, is:
- A. 75%.
  - B. 85%
  - C. 90%
  - D. 95%
15. When a missing tissue compensator is used in the treatment of the thorax, it will:
- A. reduce the variation of dose within the field.
  - B. reduce the treatment time.
  - C. produce increased phantom scatter.
  - D. necessitate a change in dose fractionation.
16. When a parotid tumor with a depth of 5.0 cm is treated, the highest skin dose would be delivered by which of the following?
- A. a direct 6 MV photon beam
  - B. a direct 18 MeV electron beam
  - C. a 6 MV photon and 18 MeV electron mixed beam
  - D. a 10 MV proton beam
17. Which of the following techniques would result in improved dose homogeneity in tangential megavoltage radiotherapy of the intact breast?
- A. using a field compensation device.
  - B. placing bolus over the skin.
  - C. using inhomogeneity corrections in the TPS.
  - D. employing a half beam block over the lung.
18. The surface dose for an 18 MeV electron beam, based on a 10x10 cm<sup>2</sup> field size, is:
- A. 75%.
  - B. 85%.
  - C. 95%.
  - D. 105%.

## MDCB PRACTICE TEST

19. What is the approximate therapeutic energy range for protons?
- A. 6 – 18 MeV
  - B. 25 – 50 MeV
  - C. 50 – 100 MeV
  - D. 150 to 250.00 MeV
20. Considering a 6 MV photon beam, which of the following would result in a decrease in PDD?
- A. decrease in field size
  - B. decrease in blocking
  - C. increase in treatment distance
  - D. increase in energy
21. Tungsten eye shields placed under the eyelid can be used to protect the eye up to what electron beam energy?
- A. 6 MeV
  - B. 9 MeV
  - C. 12 MeV
  - D. 15 MeV

## MDCB PRACTICE TEST

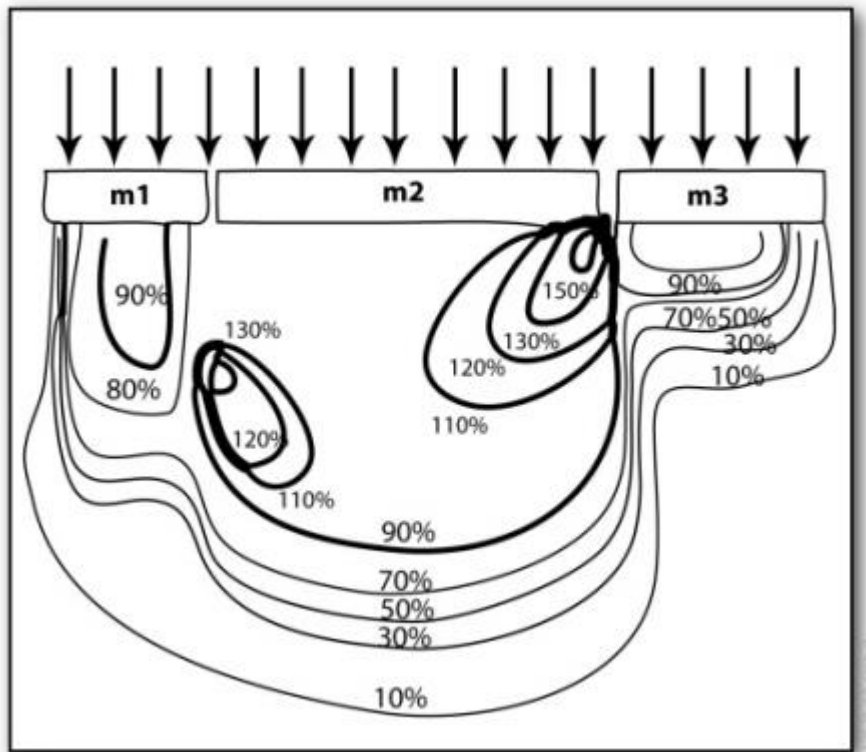
22. When comparing LET to RBE which of the following is TRUE:



- A. Cell killing is linearly related to LET.
- B. Cell killing is inversely related to LET.
- C. Lower RBE at high LET is due to lower efficiency per unit dose.
- D. Lower RBE at high LET is due to radio-resistance of the cell.

## MDCB PRACTICE TEST

23. The figure is a representation of the electron beam dose distribution through different media (m1, m2, m3), which are, respectively:



- A. air, water, lead.  
B. water, air, lead.  
C. air, lead, water.  
D. lead, air, water.
24. The most therapeutic treatment depth of electrons is given by the depth of which of the following depth dose lines?
- A. 99% to 100%  
B. 80% to 90%  
C. 60% to 70%  
D. 50% to 60%
25. The tail of an electron beam depth dose curve represents which of the following?
- A. The most useful treatment depth.  
B. The beam's uniformity index.  
C. Lower energy electrons within the beam.  
D. X-ray contamination.

## **MDCB PRACTICE TEST**

### **ANSWER KEY 3**

1. A
2. D
3. B
4. A
5. A
6. C
7. D
8. D
9. D
10. B
11. B
12. A
13. D
14. A
15. A
16. B
17. A
18. C
19. D
20. A
21. B
22. C
23. B
24. B
25. D

# MDCB PRACTICE TEST

## MDCB PRACTICE TEST 4

### STATEMENT OF PURPOSE AND USAGE

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1. The principle advantage of isocentric techniques over SSD techniques is:
  - A. the patient is not moved between fields.
  - B. treatment can be given at a higher dose rate.
  - C. it is not necessary to make immobilization devices.
  - D. published tissue phantom ratios can be used.
  
2. When treating carcinoma of the bladder, the superior border of the radiation field is limited to the superior aspect of S-1. This is to reduce toxicity to the:
  - A. pelvic crest.
  - B. small bowel.
  - C. kidney.
  - D. ureters.

## MDCB PRACTICE TEST

3. For an individual member of the public, the equivalent dose limit to the lens of the eye is:
  - A. 5.00 rem/year.
  - B. 1.70 rem/year.
  - C. 0.50 rem/year.
  - D. 0.17 rem/year.
4. I-125 has an exposure rate constant (specific gamma emission) of 1.1 R/hr/mCi and a half-life of 60.2 days. The milligram hour radium equivalency of a permanent implant of a 1 mCi Iodine 125 seed is therefore:
  - A. 193
  - B. 277
  - C. 650
  - D. 1560
5. The proper method for determining the location of the mechanical isocenter of a LINAC is to:
  - A. rotate the gantry to horizontal and align the lasers.
  - B. rotate the collimators and observe the crosshairs.
  - C. move the treatment table vertically and observe the image of the crosshairs on the surface.
  - D. rotate the gantry about a pointer mounted independently of the gantry.
6. According to the AAPM TG Report #142, when periodic LINAC quality assurance procedures are performed, which of the following is the acceptable tolerance for an optical distance indicator?
  - A. 1.0 mm.
  - B. 2.0 mm.
  - C. 3.0 mm.
  - D. 4.0 mm.
7. According to AAPM TG Report #142, when performing periodic LINAC quality assurance procedures, which of the following is the acceptable tolerance for electron flatness?
  - A. 1 %
  - B. 2 %
  - C. 3 %
  - D. 4 %
8. Autoradiography of an encapsulated brachytherapy source is a:
  - A. procedure using three radiographs to automatically identify radioactive seeds.
  - B. manufacturing process used to ensure all sources have the same activity.
  - C. method of using the sources in the patient to produce radiographs.
  - D. test for gross non-uniformity of the radionuclide within a source capsule.

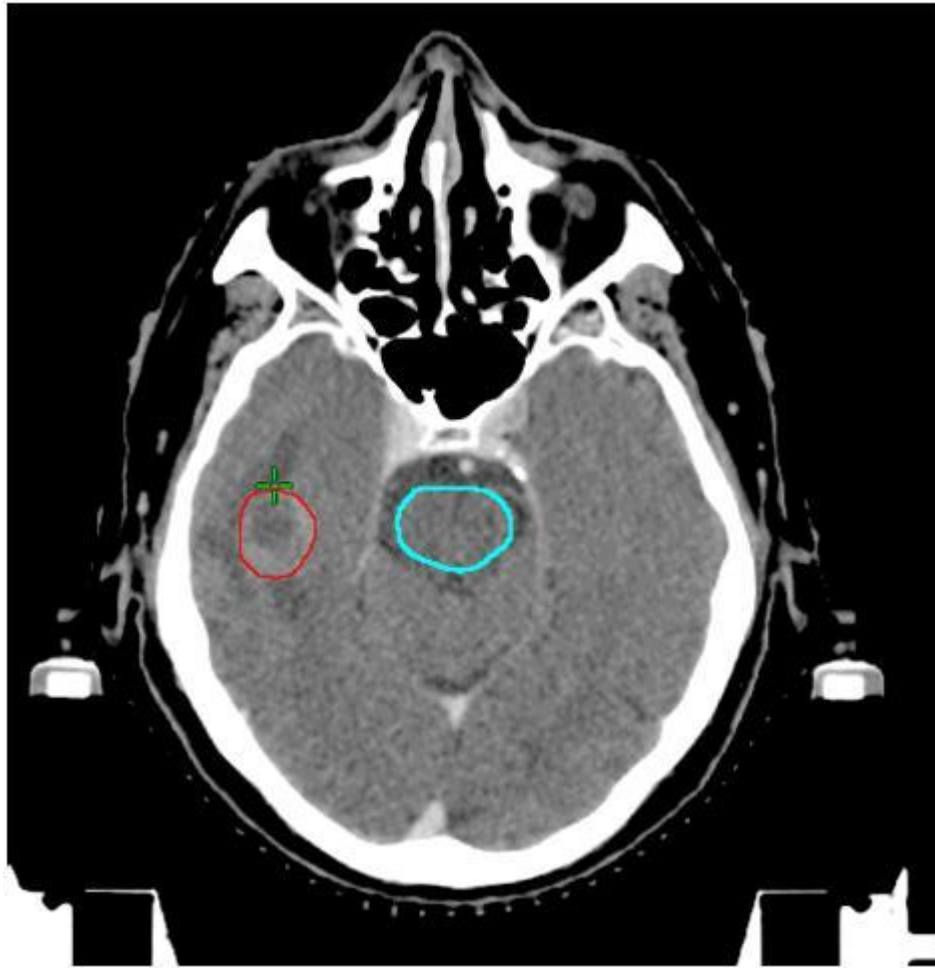


## MDCB PRACTICE TEST

9. According to NCRP Report #116 guidelines, the annual effective dose limit for continuous exposure to the whole body for the general public is:
- A. 0.5 mSv.
  - B. 1.0 mSv .
  - C. 15.0 mSv.
  - D. 50.0 mSv.
10. An individual receives a dose of 0.1 cGy from a gamma source and 0.05 cGy from neutrons. The dose equivalent from both radiation sources is:
- A. 1.1 mSv
  - B. 1.5 mSv
  - C. 8.0 mSv
  - D. 11.0 mSv
11. Mayneord F factor corrects PDD for:
- A. heterogeneity.
  - B. scatter.
  - C. Inverse square.
  - D. exponential attenuation.
12. A “field-in-field” technique is designed to decrease:
- A. hot spots.
  - B. effective energy.
  - C. treatment time.
  - D. overall MU.
13. Extra consideration of immobilization for SBRT patients is needed due to:
- A. rapid dose falloff.
  - B. length of treatment time.
  - C. multiple beams.
  - D. increased imaging time.

## MDCB PRACTICE TEST

14. According to AAPM TG #101, when the practitioner is treating the lesion outlined in RED using single fraction stereotactic radiosurgery, what is the maximum point dose allowed to the structure outlined in BLUE?



- A. 8Gy
  - B. 10Gy
  - C. 15Gy
  - D. 20Gy
15. What lead thickness is required to reduce the transmission to less than 5 percent for a 12.5 x 12.5 cm<sup>2</sup>, with a 12 MeV electron field?
- A. 1.2 mm
  - B. 3.0 mm
  - C. 5.6 mm
  - D. 8.0 mm
16. What is the total dose to the prescription point delivered by a permanent prostate seed

## MDCB PRACTICE TEST

implant using Iodine-125 seeds if the dose rate to the prescription point is 2.4cGy/hr?

- A. 2074 cGy
- B. 3456 cGy
- C. 4838 cGy
- D. 4987 cGy

17. Brachytherapy cervix applicators are often made of titanium because it:

- A. is a heavier material than plastic.
- B. is a very thick shielding material.
- C. minimizes the artifacts on CT.
- D. allows fractionation of the dose.

18. According to ICRU 38, Low Dose Rate brachytherapy (LDR) is defined as being in which dose rate range?

- A. 0.1 to 1 Gy/hr
- B. 0.4 to 2 Gy/hr
- C. 0.6 to 4 Gy/hr
- D. 0.8 to 6 Gy/hr

19. The storage area for radioactive sources containing encapsulated powder or microspheres should be ventilated by a direct filtered exhaust to the outdoors because of:

- A. lead and lead oxide in the room.
- B. possible radioactive material leaks from damaged sources.
- C. beta contamination from decay products.
- D. NCRP recommendations.

20. If the exposure rate constant is  $0.87 \text{ Rcm}^2\text{hr}^{-1}\text{mCi}^{-1}$  and the average patient transmission factor is 0.20, the exposure rate at 12.5 cm for a patient who has been injected with 20 mCi of Tc99m is:

- A. 18 mR/hr.
- B. 20 mR/hr.
- C. 22 mR/hr.
- D. 25 mR/hr.

21. The exposure rate emitting from a brachytherapy safe is found to be 25 mR/hr at 1 m from the safe source. The minimum thickness of shielding necessary to reduce the exposure to an adjacent secretary's office to an acceptable level would be:

## MDCB PRACTICE TEST

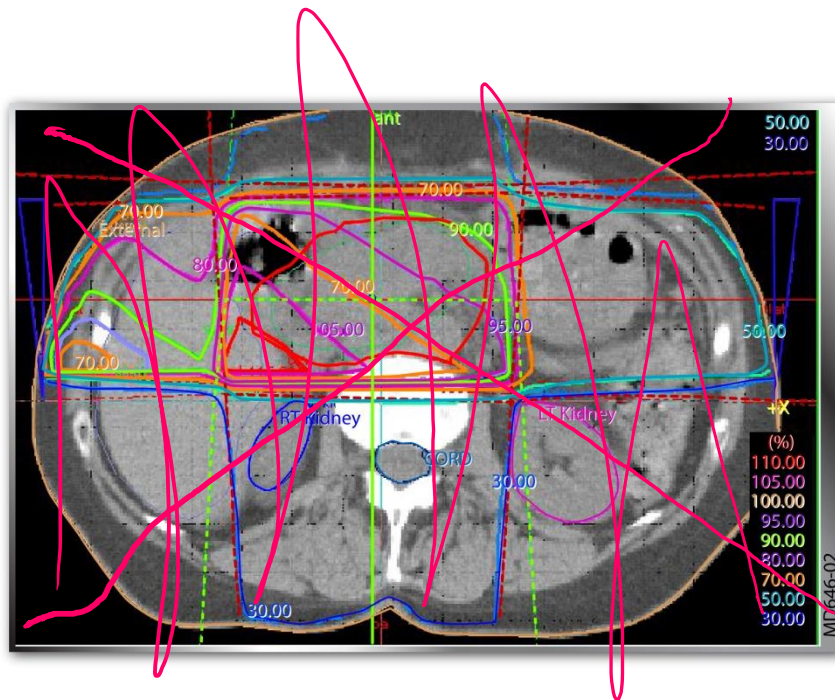
- A. 1 TVL.
  - B. 2 TVL.
  - C. 10 TVL.
  - D. 12 TVL.
22. According to the AAPM TG Report #142, the constancy of dose per monitor unit for photon beams of a LINAC should be checked:
- A. daily.
  - B. once a week.
  - C. once a month.
  - D. every three months.
23. According to the AAPM TG Report #142, when performing periodic LINAC quality assurance procedures, which of the following is the acceptable tolerance for light/radiation field coincidence?
- A. 1.0 mm
  - B. 2.0 mm.
  - C. 3.0 mm
  - D. 4.0 mm
24. According to the NRC, a brachytherapy recordable event is an administration of a dose that differs from the prescribed dose by more than:
- A. 3%.
  - B. 5%.
  - C. 10%.
  - D. 15%.
25. For quality assurance of brachytherapy treatment planning computers, the dose rates should agree with published data tables to which of the following degrees?
- A.  $\pm 1\%$
  - B.  $\pm 2\%$
  - C.  $\pm 3\%$
  - D.  $\pm 5\%$
26. The expected accuracy of treatment planning systems that perform brachytherapy dose calculations should be within:
- A.  $\pm 3\%$

## MDCB PRACTICE TEST

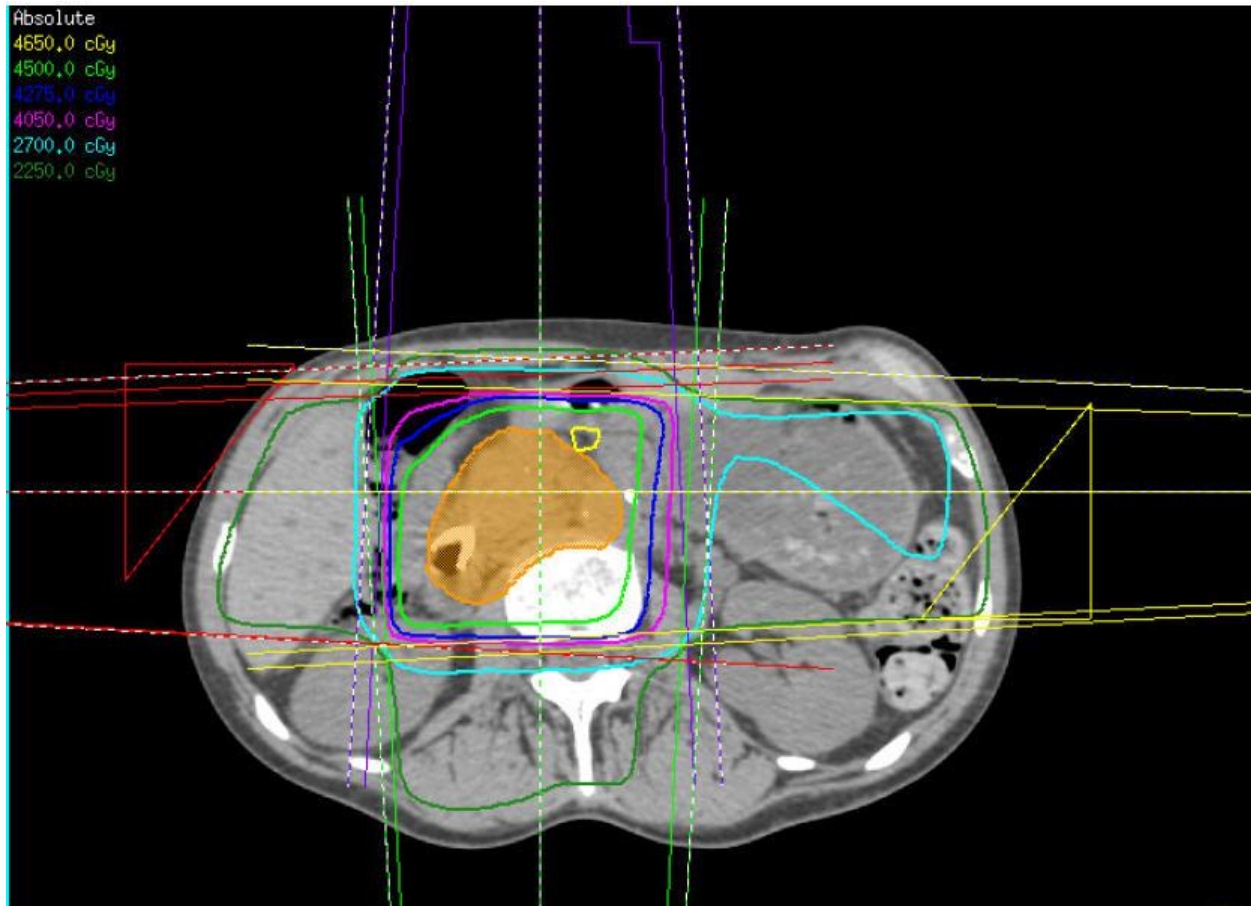
- B. +/- 5%
  - C. +/- 7%
  - D. +/- 10%
27. The decay constant for a radioactive source which has a half-life of 60 days is:
- A. 0.012
  - B. 0.170
  - C. 0.662
  - D. 1.250
28. The number of nuclei decaying per second is expressed in terms of their:
- A. decay constant
  - B. mean life
  - C. specific gamma constant
  - D. activity
29. Which of the following expressions is CORRECT for exponential decay of radioactive sources?
- A.  $e^{(0.693 \times T_{1/2}/t)}$
  - B.  $e^{(-0.693 \times t/T_{1/2})}$
  - C.  $e^{(0.693 \times t/T_{1/2})}$
  - D.  $e^{(T_{1/2} \times t/.693)}$
30. Which of the following CT scan spacing and thickness combinations would provide the best resolution in a digitally reconstructed radiograph (DRR)?
- A. 3 mm spacing, 5 mm thickness
  - B. 5 mm spacing, 3 mm thickness
  - C. 3 mm spacing, 3 mm thickness
  - D. 5 mm spacing, 5 mm thickness
31. The high dose regions or "horns" near the surface in the periphery of the field are caused by:
- A. penumbra
  - B. flattening filter
  - C. scattering foil
  - D. field asymmetry
32. Prior to treating Head and Neck patients with IMRT, a 3-field technique was used. Choose the best option to keep the cord dose under cord tolerance when total prescription dose would normally go higher than 50Gy.
- A. Stop the treatments when cord dose tolerance is reached
  - B. Continue treatments while reporting the cord dose to physician

## MDCB PRACTICE TEST

- C. Treat AP/PA with posterior cord block
  - D. Reduce lateral fields posteriorly and add posterior electron beam fields
33. Physical penumbra width is defined as the lateral distance between which two isodose curves at the level of  $D_{max}$ ?
- A. 10% and 90%
  - B. 20% and 50%
  - C. 20% and 90%
  - D. 30% and 95%
34. What will be the effect on the isodose distribution when the dose normalization point is moved close to the chest wall from the breast apex?
- A. over wedge
  - B. under wedge
  - C. hot spots move medially
  - D. hot spots move laterally



## MDCB PRACTICE TEST



35. A 4-field abdomen used to treat pancreas cancer. Prescription Dose is 45Gy. Viewing the CT Axial image and the planning information provided within the image please evaluate the plan. Choose the best answer related to the image.

- A. insufficient coverage
- B. incorrect energies used
- C. inhomogeneity correction is turned off
- D. inefficient use of wedges

36. Which is the most appropriate electron energy for a boost to treat nodes at a depth of 3.0 cm, while sparing the spinal cord at a depth of 5.0 cm?

- A. 6 MeV
- B. 9 MeV
- C. 12 MeV
- D. 16 MeV

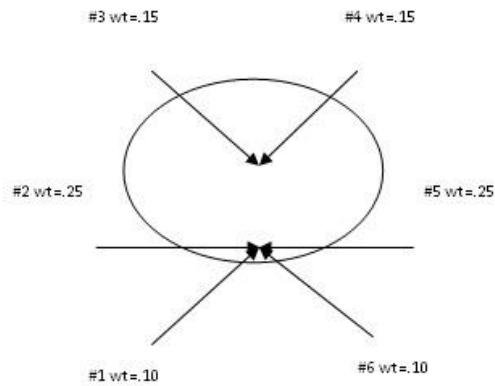
## MDCB PRACTICE TEST

37. An ipsilateral fibrotic lung lesion resulted after electron arc for breast cancer. The most probable cause is:
- A. a new metastatic lesion.
  - B. improper dosage.
  - C. incorrectly chosen energy.
  - D. concentrated *bremsstrahlung* dose.
38. Which of the following primarily determines the depth of penetration of electrons?
- A. proton to electron ratio
  - B. electrons per gram
  - C. electron density
  - D. electron energy
39. The advantage of an electron beam over a kilovoltage X-ray beam for the treatment of superficial tumors is:
- A. better depth dose.
  - B. lateral coverage and beam definition at depth.
  - C. decreased dose to bone.
  - D. higher surface dose.
40. Which of the following organs is most susceptible to a pathophysiologic injury due to its serial functional subunits?
- A. spinal cord
  - B. kidney
  - C. lung
  - D. liver
41. The five-year survival rate for a pancreatic cancer tumor treated with primary radiation is:
- A. 0% to 5%.
  - B. 5% to 10%.
  - C. 25% to 30%.
  - D. 50% to 70%.
42. Which of the following is the term for an IMRT technique in which the patient is treated slice by slice analogous to CT imaging?
- A. tomotherapy
  - B. proton therapy
  - C. step-and-shoot therapy
  - D. intensity modulated arc therapy



## MDCB PRACTICE TEST

43. A 6-field pelvis plan delivers 180 cGy/tx. the physician wants to prescribe dose to the 95 percent Isodose line. Using the weighting assigned to each beam, what is the dose to each beam, in order, of beam # 1 - 6?



- A. 19cGy, 47cGy, 28cGy, 28cGy, 47cGy and 19cGy
- B. 17cGy, 43cGy, 27cGy, 27cGy, 43cGy and 17cGy
- C. 18cGy, 45cGy, 28cGy, 28cGy, 45cGy and 18cGy
- D. 13cGy, 13cGy, 15cGy, 15cGy, 45cGy and 47cGy

## MDCB PRACTICE TEST

### ANSWER KEY 4

- |       |         |
|-------|---------|
| 1. A  | 23. B   |
| 2. B  | 24. C   |
| 3. A  | 25. B   |
| 4. B  | 26. B   |
| 5. D  | 27. A   |
| 6. B  | 28. D   |
| 7. C  | 29. B   |
| 8. D  | 30. C   |
| 9. B  | 31. B C |
| 10. D | 32. D   |
| 11. C | 33. C   |
| 12. A | 34. B   |
| 13. A | 35. D   |
| 14. C | 36. B   |
| 15. C | 37. D   |
| 16. D | 38. D   |
| 17. C | 39. C   |
| 18. B | 40. A   |
| 19. B | 41. A   |
| 20. C | 42. A   |
| 21. B | 43. A   |
| 22. A |         |

## MDCB PRACTICE TEST SET

### MDCB PRACTICE TEST 5

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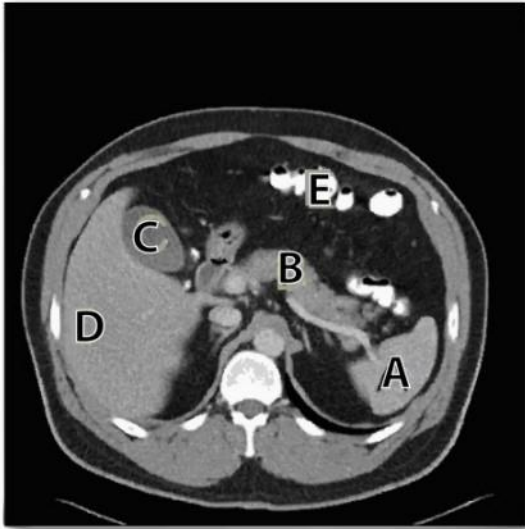
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1. The histologic type of lung cancer most responsive to radiation and/or chemotherapy is:
  - A. large cell
  - B. small cell
  - C. squamous cell
  - D. adenocarcinoma
  
2. Integral dose is the LOWEST in which of the following beam arrangements for prostate cancer?
  - A. 9 field intensity modulated radiation therapy (IMRT)
  - B. right and left lateral photon beams
  - C. 6 field IMRT
  - D. right and left lateral proton beams

## MDCB PRACTICE TEST SET

3. ICRU Report #62 is a method of delineation of an ITV to provide extra margin for:
- A. geometric penumbra.
  - B. those calculating with bone heterogeneities.
  - C. fields utilizing intensity modulation.
  - D. anatomy that may move with respiration and breathing.



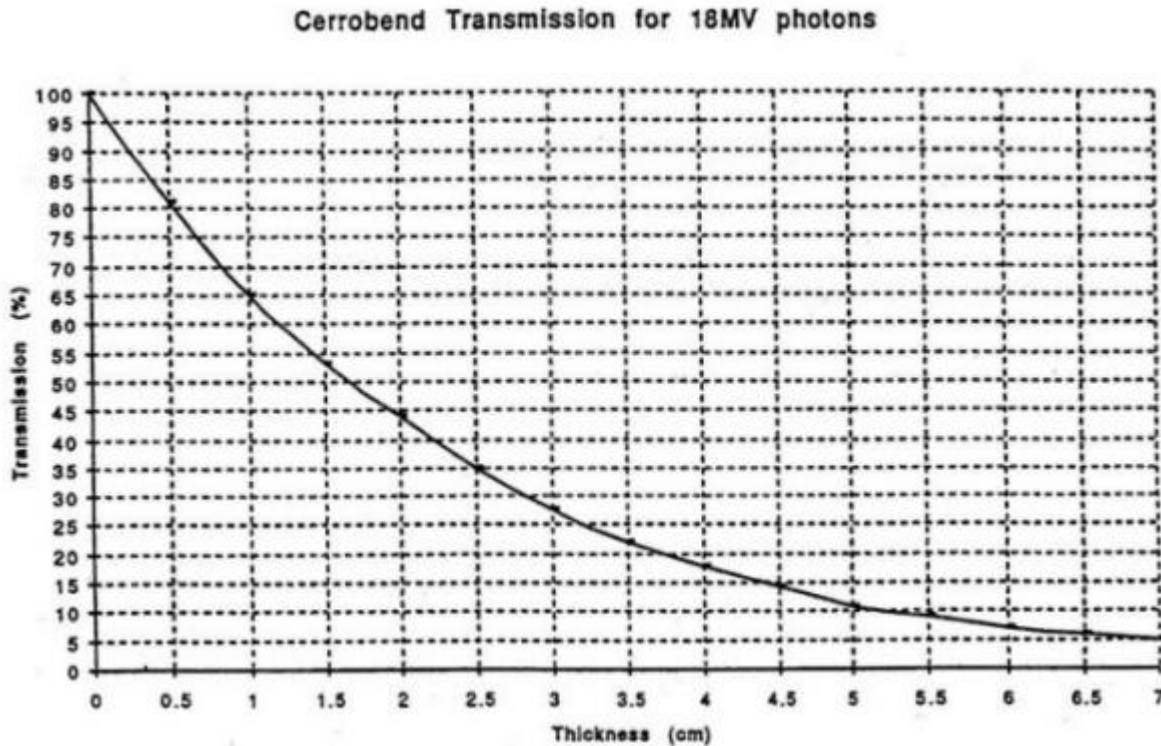
4. Identify the structure in CT Image labeled "C".
- A. liver
  - B. gall bladder
  - C. duodenum
  - D. right kidney

## MDCB PRACTICE TEST SET

5. Which of the following Hounsfield units is most closely related to lung tissue?
- A. -1000
  - B. -750
  - C. 0
  - D. +700
6. Which technique may reduce the amount of small bowel in pelvic fields?
- A. Treating patient prone in the belly board.
  - B. Elevating the patient's legs 30 degrees
  - C. Ensuring the patient has an empty bladder
  - D. Placing a balloon in the patient's rectum
7. For which of the following malignancies has hyper-fractionated radiation therapy been shown to significantly improve local control compared with standard fractionation?
- A. pediatric brainstem tumors
  - B. low-grade sarcomas
  - C. adult high-grade gliomas
  - D. head and neck cancer
8. The maximum dose near the patient surface for equally weighted parallel opposed fields increases relative to the midpoint dose as which of the following occurs?
- A. Beam energy increases.
  - B. Target-source distance increases.
  - C. Field size increases.
  - D. Patient thickness increases.
9. The central axis of a 6 MV X-ray beam traverses 2.5 cm of soft tissue, 11.0 cm of lung, and 3.5 cm of soft tissue. The density of the lung is  $0.2 \text{ g/cm}^3$ . The effective path length along the central axis is:
- A. 3.4 cm.
  - B. 5.4 cm.
  - C. 8.2 cm.
  - D. 17.0 cm.

## MDCB PRACTICE TEST SET

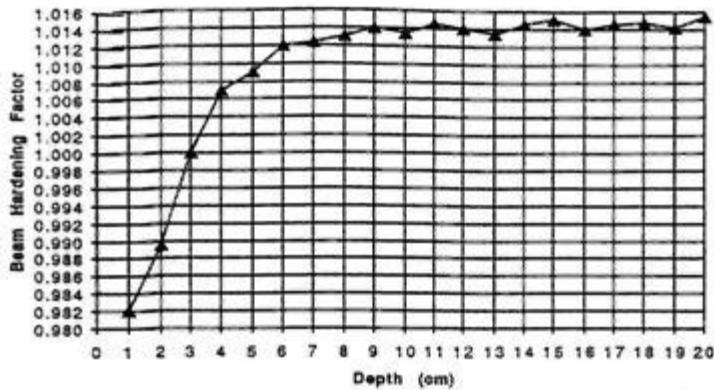
10. The dose rate from a 6 MV LINAC is 240 cGy/min at 100 cm from the source. A piece of material equivalent to three (3) half value layers (HVLs) placed in the beam will change the dose rate to:
- A. 720 cGy/min.
  - B. 80 cGy/min.
  - C. 40 cGy/min.
  - D. 30 cGy/min.



11. A 5.5cm thick cerrobend block was used to shield a field on a patient who was treated on an 18 MV linear accelerator. If 4000 cGy in 20 fractions would be delivered to  $d_{max}$  in the open field, what is the approximate  $d_{max}$  dose to the center of the shielded area under the block?
- A. 240 cGy
  - B. 300 cGy
  - C. 360 cGy
  - D. 420 cGy

# MDCB PRACTICE TEST SET

60 Degree Wedge Beam Hardening Factor Diagram



Output Factor Table

Width (cm)	Length (cm)			
	6	8	10	12
6	0.957	0.969	0.974	0.975
8	0.969	0.982	0.994	1.001
10	0.974	0.980	1.000	1.010
12	0.975	0.994	1.009	1.018

Open Field Tissue Phantom Ratio (TPR) Table  
(normalized to 1.000 for 3 cm depth)

Depth (cm)	Field Size (cm)					
	7	8	9	10	11	12
7	0.846	0.847	0.851	0.860	0.867	0.872
8	0.817	0.819	0.823	0.831	0.839	0.845
9	0.787	0.791	0.796	0.804	0.811	0.817
10	0.757	0.762	0.768	0.776	0.783	0.789
11	0.726	0.731	0.737	0.747	0.756	0.763
12	0.698	0.703	0.708	0.719	0.729	0.736

12. A patient's treatment setup has a depth change from 10 cm to 9 cm. The 8 x 10 cm<sup>2</sup> (w x l) field has a degree wedge (wedge factor 0.55). According to the information in the tables above, if 80 cGy is given to this field at isocenter, the number of new ~~monitor units (MU)~~ will be:

- A. 100 MU
- B. 144 MU
- C. 179 MU
- D. 181 MU

## MDCB PRACTICE TEST SET

13. When a coefficient of equivalent thickness (CET) is used for an inhomogeneity, the CET factor equates the inhomogeneity to an equivalent thickness of:
- A. air.
  - B. water.
  - C. lung.
  - D. cartilage.
14. The tilt that an isodose curve makes with the central ray of a beam at a specified depth is called the:
- A. wedge factor
  - B. wedge angle
  - C. hinge angle
  - D. edge effect
15. TMR depends on:
- A. energy and field size.
  - B. energy, depth, field size, and SSD.
  - C. energy and SSD.
  - D. energy, field size, and depth.
16. The TMR is the ratio of the dose in a phantom at depth to the dose in the:
- A. phantom at any defined reference depth and field size.
  - B. phantom at the depth of maximum dose for a 10 x 10 cm<sup>2</sup> field size.
  - C. phantom at a depth of 5.0 cm for the same field size.
  - D. phantom at the depth of maximum dose for the same field size.
17. The field size on a simulation film appears to be 15 x 15 cm<sup>2</sup> at 140cm source-to-film distance (SFD). What will the field size be at 100cm?
- A. 15 x 15 cm<sup>2</sup>
  - B. 7.5 x 7.5 cm<sup>2</sup>
  - C. 10.7 x 10.7 cm<sup>2</sup>
  - D. 21 x 21 cm<sup>2</sup>
18. Craniospinal irradiation is to be performed using a PA spine port (100 cm SSD, 38.0 cm long) and lateral brain ports (100 cm SAD, 18.0 cm long). How many degrees must the collimator and the table be rotated to make sure all beam edges match?
- A. Collimator 10.8 degrees, Couch 5.1 degrees
  - B. Collimator 5.1 degrees, Couch 10.8 degrees
  - C. Collimator 20.8 degrees, Couch 10.2 degrees
  - D. Collimator 10.2 degrees, Couch 20.8 degrees



## MDCB PRACTICE TEST SET

19. If a radiograph is taken at 100 cm source to skin distance and a 2.5 cm magnification ring placed on the skin measures 3.25 cm on the film, the magnification factor is:
- A. 0.80
  - B. 1.04
  - C. 1.25
  - D. 1.30
20. When the equivalent square of a rectangular field is calculated, the result is less accurate when the:
- A. sides of the rectangular field are not vastly different.
  - B. areas of the two fields are similar.
  - C. field has an elongation ratio of 2.0.
  - D. beam energy is greater than 6 MV.
21. In radiation protection surveys, the measurements of low levels of x-rays are performed using:
- A. solid state diodes.
  - B. optically stimulated luminescent dosimeters.
  - C. Geiger counters.
  - D. gaff chromic film.
22. The NCRP Report #116 guidelines for occupational radiation protection recommends that all organs, other than the lens, not exceed an annual equivalent dose limit greater than:
- A. 50 mSv.
  - B. 150 mSv.
  - C. 300 mSv.
  - D. 500 mSv.
23. According to NCRP recommendations, the cumulative effective dose limit for occupational exposures ~~is~~are:
- A.  $(\text{age} - 18) \times 3$ .
  - B. 5 mSv annual limit.
  - C. five times the public limit.
  - D.  $10 \text{ mSv} \times \text{age in years}$ .
24. What is the electron energy that will give dose coverage  $\geq 93\%$  of the prescription dose to a target volume that extends from 0.5 cm to 2.5 cm below the skin surface and has an 8 mm bolus placed on the skin, while minimizing the dose to an underlying avoidance structure at 4.5 cm from the skin surface to  $< 50\%$  of the prescribed dose?
- A. 9 MeV
  - B. 12 MeV
  - C. 16 MeV
  - D. 20 MeV

## MDCB PRACTICE TEST SET

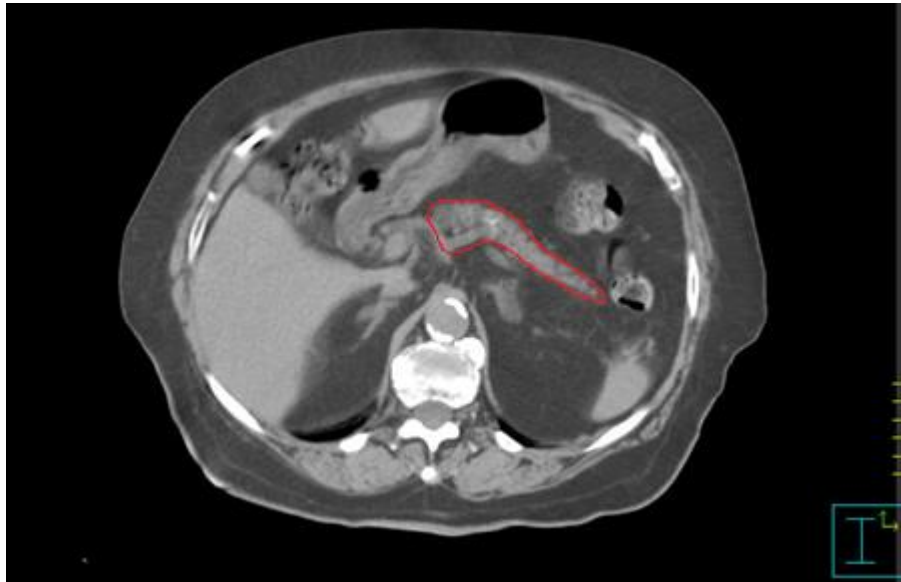
25. According to the AAPM TG Report #40, what is the minimum recommended frequency and percentage tolerance for checking x-ray beam symmetry on the linear accelerator?
- A. Daily, +/- 2%
  - B. Daily, +/- 3%
  - C. Monthly, +/- 2%
  - D. Monthly, +/- 3%
26. Based on the alpha/beta model-, which of the following tissues would be classified as an early responding?
- A. spinal cord
  - B. kidney
  - C. lung
  - D. skin
27. A 10x10 electron cone was damaged in the treatment room. A replacement cone was ordered. Which of the following statements is TRUE?
- A. The output must be measured for any new cone.
  - B. The output must be re-measured for all cutouts.
  - C. The output tables will remain the same with the new cone.
  - D. If the cone is from the same vendor no measurements are necessary.
28. Which of the following is not a role of the medical dosimetrist?
- A. assessing selection of beam orientation and weighting
  - B. evaluating the plan for target coverage and normal tissue exposure
  - C. verifying that the prescription matches the treatment plan
  - D. defining the target of radiation
29. Which of the following statements is TRUE about Hounsfield numbers?
- A. They are the product of translation and rotation in PET.
  - B. They relate signal strength and tissue density in MRI.
  - C. They are used to convert dose integrator settings to cGy in high-energy linear accelerators.
  - D. They represent the change in linear attenuation coefficient relative to water in CT.
30. PET, CT, and MRI data can be transferred for image fusion and treatment planning by:
- A. PDF.
  - B. JPEG.
  - C. TIFF.
  - D. DICOM.

## MDCB PRACTICE TEST SET

31. The most common site of metastasis for Ewing's sarcoma is the:

- A. lung.
- B. liver.
- C. brain.
- D. eye.

32. Identify the outlined structure.



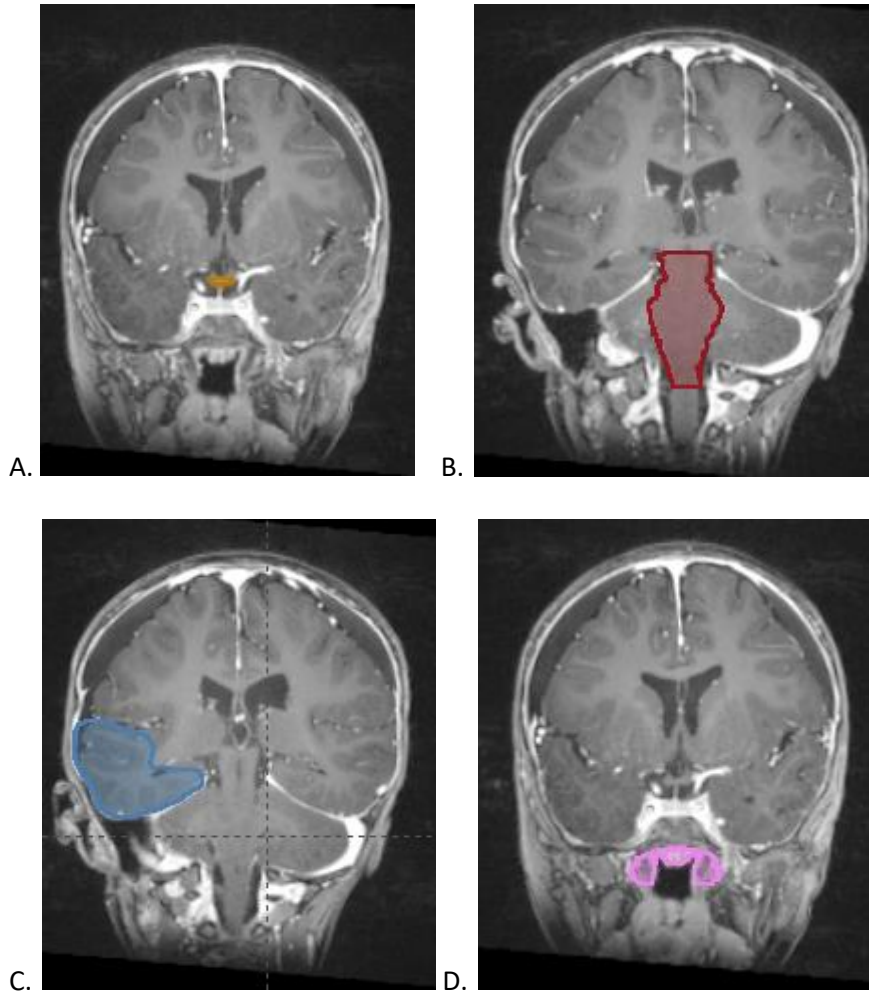
- A. adrenal gland
- B. duodenum
- C. pancreas
- D. stomach

33. Mayneord F factor corrects for:

- A. PDD.
- B. scatter.
- C. inverse square.
- D. exponential attenuation.

MDCB PRACTICE TEST SET

34. Irradiation of which of the following structures can directly result in neurocognitive dysfunction?



- A. image A  
B. Image B  
C. Image C  
D

35. When a high-speed electron interacts with a nucleus in the target of a LINAC and suffers a sudden deflection, it is then emitted as what form of electromagnetic radiation?

- A. Compton  
B. *bremsstrahlung*  
C. characteristic  
D. pair production

## MDCB PRACTICE TEST SET

### ANSWER KEY 4

1. B
2. D
3. D
4. B
5. B
6. A
7. D
8. D
9. C
10. D
11. C
12. D
13. B
14. B
15. D
16. D
17. C
18. A
19. D
20. C
21. C
22. D
23. D
24. B
25. D
26. D
27. A
28. D
29. D
30. A
31. A
32. C
33. A
34. C
35. B

## MDCB PRACTICE TEST SET

### MDCB PRACTICE TEST 5

#### STATEMENT OF PURPOSE AND USAGE

The Medical Dosimetrist Certification Board ("MDCB") continues to develop and administer certification examinations intended to measure skill and knowledge. Successful completion of the MDCB's examinations and certification by it is intended to act as an indicator to medical professionals, patients and the general public that an individual possesses a specific level of skill. Because persons who require the services of a Medical Dosimetrist are generally suffering from serious conditions and diseases, treatment by and with a certified expert is intended to provide a level of assurance as to the professional's qualifications.

Test integrity and security are paramount concerns. The use of legitimate study, reference and preparation materials is appropriate and expected. For that reason, the MDCB has assembled the Sample Practice Tests Manual (the "Manual") for use by candidates. The items contained in the Manual are retired test questions. They provide a candidate with examples of the type of questions, which may appear on the actual examination, and the possible format of the questions. They also demonstrate difficulty levels and may provide some information relating to test content, which has been addressed in prior examinations.

None of the items in the Manual should be relied upon for accuracy or correctness. Because of progress in the field and changes in the scientific arts, content, which may have been current when an item was in use, may no longer be accurate. What was once the best answer to a question may no longer be current. Candidates are advised that the information in the Manual should be confirmed by independent study and research. The Manual is intended to provide candidates with a general familiarity of the examination style and format and is meant to foster study and preparation. It should not be relied upon as authoritative or necessarily substantive.

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1. DICOM allows:
  - A. Imaging modalities and PACS to communicate in the same language.
  - B. A networked group of computers to manage digital images.
  - C. X-ray absorber material and a charged coupled device to form an image.
  - D. Improved image quality in digital portal films.
  
2. The PTV provides margin around the ~~Gross Tumor Volume~~ GTV and/or ~~Clinical Tumor Volume~~ CTV to compensate for which of the following?
  - A. positive margins at tumor bed.
  - B. inconsistencies in physician drawing.
  - C. dose fall off.
  - D. variations in treatment setup.
  
3. The accuracy of a DVH depends on which of the following?
  - A. Normal Tissue Complication Probability Value
  - B. number of OARs assessed
  - C. Biological Equivalent Dose
  - D. bin size of histogram

4. Which of the following concepts of 3-dimensional conformal radiotherapy is/are correctly defined?
  - A. Differential DVH: Plot of a volume of a structure receiving a certain dose as a function of dose
  - B. BEV: display of target and normal tissues parallel to the beam
  - C. GTV: gross demonstrable extent of tumor
  - D. PTV: true extent and location of disease
  
5. Which statement is TRUE about the benefits of PET-CT for use in Radiation Oncology treatment planning?
  - A. PET images show chemical or metabolic activity within the body.
  - B. PET images provide superior anatomical definition over CT images.
  - C. PET images have an accuracy of 10-15 mm for anatomical location.
  - D. PET imaging is ideal for diabetic patients.
  
6. In megavoltage therapy, all beam modifying devices should be placed at least 20.0 cm from the patient's skin surface because:
  - A. the increase in half value layer (HVL) adversely affects skin dose.
  - B. alpha particles will not reach the skin's surface
  - C. percentage depth dose (PDD) is increased.
  - D. secondary electrons are scattered before reaching the patient.
  
7. When boosting the ethmoid sinus with electrons, where would the hot spot(s) be expected to occur?
  - A. along the surface of the irregularity.
  - B. at the appropriate  $d_{max}$  for that energy.
  - C. at the bony interface.
  - D. along the air cavity interface.
  
8. Which of the following commonly employ beams as small as 4.0 mm in diameter?
  - A. intensity modulated radiation therapy (IMRT)
  - B. proton beam therapy
  - C. 3-D conformal therapy
  - D. stereotactic radiosurgery
  
9. Which of the following options will increase dose computation speed of a treatment planning computer?
  - A. decrease the resolution of the calculation grid.
  - B. compute the dose distribution over a large region
  - C. increase the RAM of the server blade
  - D. super-sample the OAR

10. Prominent factors that affect megavoltage radiation dose distributions as a result of tissue inhomogeneities include which of the following?
- A. the source to skin distance
  - B. the size and location of the inhomogeneity
  - C. the use of large field sizes
  - D. the Z of the tissue irradiated
11. Technical considerations in the post-operative treatment of high-grade soft tissue sarcomas of the extremities with external beam radiation should include:
- A. Circumferential tissue sparing in the width of the field
  - B. Eliminating any shielding in the treatment field
  - C. Treating the tumor bed with minimal margins only
  - D. Using daily fractional doses of 250 cGy or more
12. For electron therapy, increasing the gap between cerrobend cut-out, placed at the end of the cone, and the treatment surface of the patient results in:
- A. a decrease in the physical penumbra at the patient surface
  - B. a decrease of electron energy to achieve the same PDD
  - C. an increase in the bremsstrahlung tail on the depth dose curve
  - D. an increase in the monitor units to achieve the same dose
13. For external beam radiation, the use of multiple photon beams (3 or more) versus a single photon beam will:
- A. decrease the ratio of the tumor dose to the normal tissue dose
  - B. decrease the amount of scatter dose to the tissue outside the irradiated volume
  - C. increase the dose to treatment volume
  - D. increase the homogeneity within the target
14. Electron beam field symmetry:
- A. is measured in a single plane parallel to the axis of the beam
  - B. Is specified in a reference plane at the depth of 95 % isodose beyond  $d_{max}$
  - C. is defined for points that are equally distanced on either side of the central axis
  - D. is measured along the central axis of the beam
15. Which type of DVH shows the volume receiving a dose within a specified dose range?
- A. integral
  - B. cumulative
  - C. organ
  - D. differential



16. When acquiring CBCT images, the dose to sensitive structures can be reduced by:
- A. adjusting the collimator blades to reduce the volume of the patient being irradiated.
  - B. using the x-ray technique to best match the clinical task.
  - C. selecting the direction of the kV beam to avoid sensitive structures.
  - D. decreasing the dose rate.
17. Which of the following is included in the ITV, as defined by the ICRU Report 62?
- A. Clinical target volume (CTV)
  - B. Gross tumor volume (GTV)
  - C. Setup margin (SM)
  - D. Internal margin (IM)
18. In electron beam therapy, if an air gap results in beam obliquity and is not accounted for in the plan, it:
- A. shifts the  $d_{\max}$  deeper
  - B. shifts  $d_{\max}$  towards the surface
  - C. changes the degree of lower isodose bulge
  - D. decreases side scatter at  $d_{\max}$
19. When treating chest wall tumors with multiple electron fields, which of the following considerations should be taken?
- A. Angling the beams towards each other
  - B. Use the same electron energies for field matching
  - C. Feather the junctions periodically
  - D. Overlap the fields purposely to account for motion
20. A 12 MeV electron beam displays which of the following characteristics?
- A. maximum dose occurs at the surface
  - B. depth of 80% dose is approximately 4.0 cm
  - C. the practical range is 5.0 cm
  - D. depth of maximum dose is 1.6 cm
21. Which of the following criteria is information required to be included in the *written directive* for the medical use of radioactive materials?
- A. verification methods for confirming the patient identity
  - B. the x, y and z coordinate locations of the radioactive source
  - C. the total patient exposure time to the source
  - D. authentication of the source license

22. While performing a brachytherapy procedure the TLD badge that monitors whole-body exposure should be worn:
- A. on the hands or fingers.
  - B. near the face.
  - C. at the waistline (belt area).
  - D. on chest or abdomen.
23. Using non-coplanar beams and IMRT techniques to design a treatment plan of the pituitary gland is advantageous over traditional 3D techniques in reducing the dose to the:
- A. optic chiasm and temporal lobes.
  - B. optic chiasm and cochlea.
  - C. temporal lobes and brainstem.
  - D. brainstem and cerebrum.
24. Which of the following boost techniques can be used when treating a base of tongue cancer to preserve the swallowing function?
- A. stereotactic radiotherapy
  - B. electron therapy
  - C. opposed lateral fields
  - D. brachytherapy
25. The use of stereotactic radiotherapy is frequently used to treat which of the following cancers of the thorax?
- A. small cell lung cancer
  - B. non-small cell lung cancer
  - C. thymoma
  - D. mesothelioma
26. When using radiotherapy for the treatment of liver disease, the most dose-limiting surrounding normal tissue to be considered is:
- A. the spinal cord
  - B. the kidneys
  - C. the bowel
  - D. normal liver
27. Which of the following choices best reflects the role of radiation therapy in the treatment of cutaneous melanoma?
- A. definitive treatment of primary site
  - B. palliative treatment to metastatic site
  - C. adjuvant treatment following surgical resection
  - D. definitive treatment for regional recurrence



30. To identify beam data corruption in treatment planning systems, the best method of quality assurance includes:
- A. verifying all wedge factors.
  - B. checking all beam parameters.
  - C. running a checksum utility.
  - D. running an antivirus utility.
31. During a treatment of a 7-Field IMRT prostate, the linear accelerator "crashes" during treatment of the 4th field. The remaining three IMRT fields cannot be completed that day. Which of the following is the best option for treating the patient the next treatment day.
- A. Treat the remaining 3 fields and then treat all 7 IMRT fields.
  - B. Estimate the dose given for the partial treatment. Ignore the partial treatment and treat all 7 fields the next day.
  - C. Estimate the dose given for partial treatment. Increase the daily MU's to "make-up" the missing dose in the final 7 treatments.
  - D. Estimate the dose given for the partial treatment. Consult with the physician on adjusting the prescribed dose and number of fractions.
32. On linear accelerators, the light field coincides with what isodose line at  $d_{max}$ ?
- A. 50%
  - B. 75%
  - C. 80%
  - D. 90%
33. What is the decay constant of Co-60 in years?
- A.  $0.01 \text{ yr}^{-1}$
  - B.  $0.13 \text{ yr}^{-1}$
  - C.  $0.69 \text{ yr}^{-1}$
  - D.  $7.59 \text{ yr}^{-1}$
34. Accurate specification of dose at depth in a wedged field necessitates that the medical dosimetrist accounts for which of the following factors?
- A. same central axis percent depth dose that occurs in a wedged field
  - B. wedge transmission factor is measured in air or in tissue
  - C. no variations of the wedge transmission factor with field size
  - D. reduction in collimator scatter that is reaching the patient
35. The similarities for depth dose characteristics of megavoltage electron and photon beams is:
- A. they have a finite range of penetration.
  - B. the percent surface dose is high.
  - C. the percent surface dose increases as the energy increases.
  - D. the percent depth dose increases as the beam energy increases.

36. A network router:

- A. makes computers run faster
- B. enables safe sharing of resources among network device
- C. helps people build web sites

37. connects a computer to a monitor so that the video can be shared

Dose at any depth is greatest at:

- A. Location of normalization
- B. Along the central axis
- C. At the surface dose
- D. At the  $d_{\max}$  dose

38. What factors affect depth dose?

- A. Energy, depth, field size, SSD, blocked area
- B. Energy, depth SSD, dose build up, collimation
- C. Depth, field size, beam quality, source size
- D. Depth, energy, absorbed energy, scatter

39. Which of the following statements is a TRUE characteristic of the Compton interaction process?

- A. The Compton interaction occurs between photons and inner shell electrons.
- B. The Compton interaction produces photons of shorter wavelength than the primary photon.
- C. The Compton interaction is utilized in diagnostic radiography.
- D. The Compton interaction is proportional to the number of "free" electrons.

MDCB PRACTICE TEST SET 5

**ANSWER KEY 5**

1. A
2. D
3. D
4. C
5. A
6. D
7. D
8. D
9. C
10. B
11. A
12. D
13. D
14. C
15. D
16. A
17. D
18. B
19. C
20. B
21. C
22. D
23. A
24. D
25. B
26. D
27. C
28. D
29. B
30. C
31. D
32. B
33. B
34. B
35. D
36. B
37. B
38. A
39. D