2007_Therapy_Part II_Type

Simple Questions: (each one counts 1 point, total 53 questions/points)

1. Neutron dose equivalent (mSv) outside field per photon Gy at isocenter for 20MV beam.

2. Scatter and leakage shielding thickness calculations are equal. The shielding that should then be used is: A TL + 1HVL, B other options including Ts + TL, Ts + 1TVL.

3. Parts definitely not included in EPID – options were ion chamber, CCCD camera, mirror, silicon screen, some other dose detection device.

4. TBI – what is not true – A. Dose Uniformity < 15%, B. Tissue Equivalent Compensators are used, C. High SSD, D. AP preferred over lateral, E. Lower dose conformity with increased energy.

5. S/rho and rho given for lead. Calc thickness of lead used to shield 20MeV beam.

6. How many TVL's in a linac head?

7. PDD for wedge increases over open field due to: A. Photon interactions in the wedge B, C, D, E…..

8. Purpose of the guard ring in a plane parallel chamber is to? A. "Define the collection volume" appeared to me to be the only reasonable answer.

9. Electrons at extended SSD, which is true?
A. Width of the 90% extends proportionately B. Penumbra increases C. Output follows ISL with 100 to source …

10. Why does the equivalent square technique work? A. Because scatter doses are equal between square and rectangular fields. Other options involved statement about collimators and scatter that sounded wrong

11. TG51: what's upper limit for Pion? 1%, 3%, 5%, 10%.

12. TG51: where is cylindrical chamber's center placed for photon beam calibration?

13. TG51: to cross calibrate parallel-plate chamber, what should use?
Co60, high energy photon, high energy electron, low energy electron.

14. TG51: KQ depends on what? (choices included beam energy, ion chamber, both)

15. TG51: What's energy specification for electron beams?

16. TG51: total consecutive measurements were done with 20% difference, the reason is: 100 SSD vs 100 SAD; etc.

17. TG51: where is the effective point of measurement of parallel-plate chamber?

18. How do you convert ionization curve to %dd curve?

19. Agent used in PET? 18FDG

20. 9MeV electron beam. At 4 cm depth, how much lead should be used to shield deeper structure? No other information.

21. Difference between physical wedge and dynamic wedge. Beam hardening.

22. IMRT: Difference between simulated annealing and gradient reduction in IMRT? Faster, more accurate in dose calculation in build up, better with step-and-shoot than with sliding window, achieve global minimum instead of local, etc.

23. IMRT: one fluence map is shown for 5 fields prostate IMRT, identify the field. AP, RPO, RAO, LAO, LPO.

24. Klystron's function.

25. Gas pressure low fault is related to which part in Linac? Gun, Waveguide, Magnetron, Accelerating tube, etc.

26. Linac's outputs are off the same way for all the beams, what is the problem? klystron, bending magnet, RF waveguide, monitor chamber - I said monitor chamber because it would be the most consistent

27. What's PTV?

28. Which organ shows partial volume effect? Brachial Plexus, Kidney, Optic nerve, etc.

29. To compare light field vs. radiation field, film is used. Ask distances for SSD and film SAD. SSD=100, SAD=100; SSD=100-dmax, SAD=100; etc.

30. Photon field abuts electron field, where is the hot spot?

31. The Transport Index represents the exposure rate…. (choices included "on the surface" and "at one meter")

32. Mayneord's Factor is more accurate for: 6MV, 6x6, 110 SSD; 6MV, 30x30, 150 SSD; 15MV, 6x6, 110 SSD; 15MV, 6x6, 150 SSD; etc.

33. What "stereotactic" means in stereotactic radiosurgery

34. TG43: what is Λ?

35. Tolerance for simulator laser vs. gantry center (or some other mechanical center)?

36. Amount of X-ray contamination of 18 MeV electron beam? 1%, 4%, 10%, etc.

37. IMRT shielding: how much more shielding needed? All wall + TVL; Primary + TVL; Secondary + HVL; Secondary + TVL; etc.

38. If you were going to use a thimble chamber to calibrate an Ir192 source what type of beam would need to be used in determining the calibration factor? Calibrate with 192Ir; Calibrate with 380 keV X-ray, Cobolt-60 etc.

39. 45Gy photon treatment to neck. Choose electron energy for boost to treat nodes at 3cm depth and spare cord at 5cm depth.

40. Treat 4.3 cm depth with 12 MeV and 200 cGy, dose at dmax.

41. Multi detector CT, when cone beam increases size, what's true: Collimator decreases, scatter photon increases, etc. (not quite sure about the answers)

42. Shielding: What's peak energy of photons near door? 200 keV, 500 keV, etc.

43. Shielding: Electron only machine has 4 electron energies, each with 3.5%, 2%, 1.5%, and 1% X-ray contamination. Workload 200 Gy/week, what is weekly workload for photon contamination?

44. Decay rate of 192Ir per day.

45. Weekly dose limit for unrestricted area.

46. GM counter property.

47. A question involving 10mg Ra – simple application of ΓxA/d2 – but needed to know (i.e. not given) exposure rate const. = 8.25 Rcm2/mg.hr

48. Breast Tangent pair. Field widths at 100 SAD = 10.5 cm. LAO has gantry angle 45 degrees. What gantry angle does RPO have such that posterior borders will be parallel?

49. Difference between Acceptance Test and Commission of Linac.

50. Tolerance for deviation in a light field for a CT sim

51. How much dose is given for an I-125 seed 1.44DoT1/2(1 - e^ln2/t1/2*t)

52. What is the dose rate at 1m from a patient receiving external beam treatment

53. If the high voltage power source is pushing too much, what is the most likely observed result on the accelerator.

54. Which modality (photons or electrons) and energy is used to cross calibrate a parallel-plate chamber with a cylindrical chamber.

55. Electron beam quality is specified by (R50, Dref etc, dmax etc)

56. Given a table of PDD's 4 MV and 18 MV what is the ratio of max dose 4MV/18MV.

57. Effect on point outside treatment field when using dynamic wedge versus hard wedge.

Complex Questions: (each one counts 3 points, 27 questions, and total points 81)

1. HDR, three dwell positions (1, 2 and 3 – 2 in middle) 1cm apart in single channel. Dose points A, B and C 1cm perpendicular to dwell positions 1, 2 and 3 respectively. What is the ratio of dwell times 1 to 2 to make dose A equal dose B?

2. AP/PA doses given from each field to cord for 200 cGy to tumor (62cGy, 150cGy respectively). Cord block put in PA, new cord dose is 18% of original. How many fractions need cord block to limit cord dose to 40Gy?

3. A lead pig with 2 cm wall thickness is inside a 30cm diameter polyurethane foam shipping drum. HVL of lead was given (=5.5mm). Exposure rate constant of 192 Ir was given (0.32 mR/mCi hr at 1 meter). Calculate max activity to keep exposure rate below 50mR/hr on the drum surface.

4. TBI, diode reading 450cGy on surface, prescribed midline 600cGy POP laterals, 30cm separation. TMRs were given with 350cmSSD. What is error in midline dose? A. 2.6% higher, etc.

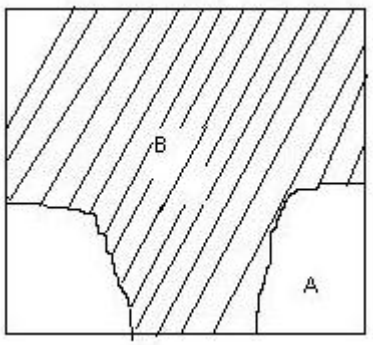
5. Three isocentric beams 120 deg apart, AP and post obliques. Each goes through 15 cm depth to isocenter. 180Gy at isocenter weighted equally for three beams. Post beams transfer 9cm lung (electron density= 0.33), TMRs given at 3,6,9,12,15 cm. Calculate MU(post obliques)/MU(AP).

6. Ratio of Maximum Dose between 25MV and 4MV for same dose to midline using POP setup with SSD =100cm. PDD's given.

7. Given Kersey's formula and the distances and ratio of maze areas, neutron dose at isocenter (mSv) per photon cGy at isocenter, what is neutron dose (mSv) at door per photon cGy at iso. Told TVL of maze for neutrons is 5m.

8. HDR 192Ir. Patient treated with time 420sec with Activity 3.75Ci on Aug 1st. Source got replaced with activity 9.43Ci on Aug 16th. Calculate treatment time on Aug 21st. No 192Ir half life given.

9. Given dose to point A 200 cGy, calculate thickness of block to achieve point B dose 90 cGy. TMR, %DD, and HVL given, depth may be different for B.



10. 36 inch space is available for 6 TVL shielding. Given Pb TVL (2 inch) and Concrete TVL (18 inch), what is the minimum thickness of Pb needed?

11. Sim film taken at 102cm SSD, SFD 140cm. Want to treat at 120cm SSD. What distance to film should be used when cutting blocks.

12. Field size is measured 56 cm on patient skin and collimator 40 cm with table at its lowest position 167 cm from the source. What's patient size (including setup bag etc.)?

13. Given diagram of one dimension blocked field with distance from CAX and table of SARs (0cm 6cm 9cm 10cm etc), calculate SAR. (| | Block | |)

14. Superficial X-ray, measurement at end of cone gives a reading of 150. Measurement at 10cm from the end of the cone gives a reading of 52.3. What is the effective SSD at the end of the cone?

15. Dose to cord from AP/PA 100 SAD setup. Given 22cm separation, cord 4cm deep, and 200cGy to isocenter.

16. Film exposed for dosimetry. Given transmitted light is 200 times smaller than original, what is the dose? OD vs dose table was given.

17. Single field 125 cm SSD, 4x17. 300cGy was prescribed to 5cm deep. Given PDD table and TMR table, calculate MU. No Output factor vs. field size! No machine calibration condition, SSD or SAD!

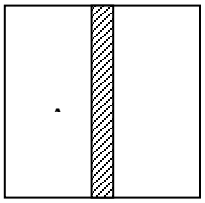
18. 15 x 20 POP, calculate MU for dose required. No Output factor vs. field size! No machine calibration condition, SSD or SAD!

19. Multiple beams plan: AP weighted to 100% at dmax, laterals weighted to 100% at dmax. 200 cGy delivered to 238% isodose line. What is the dose delivered by AP beam?

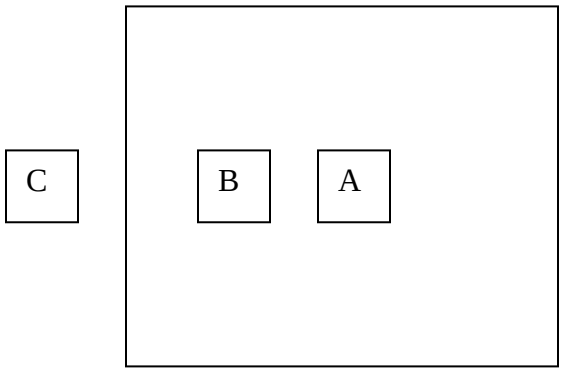
20. Given readings at 10 cm depth for 10 x 10 and 20 x 20 fields with 100 cm SAD, and two TMRs, calculate the Scp(20).

21. 15 x 15 field with 3 x 15 block in the center, which has 5% transmission factor. Depth at 7 cm, dose to point A given with 1.01 OCR, calculate dose to CAX under block, given table like:

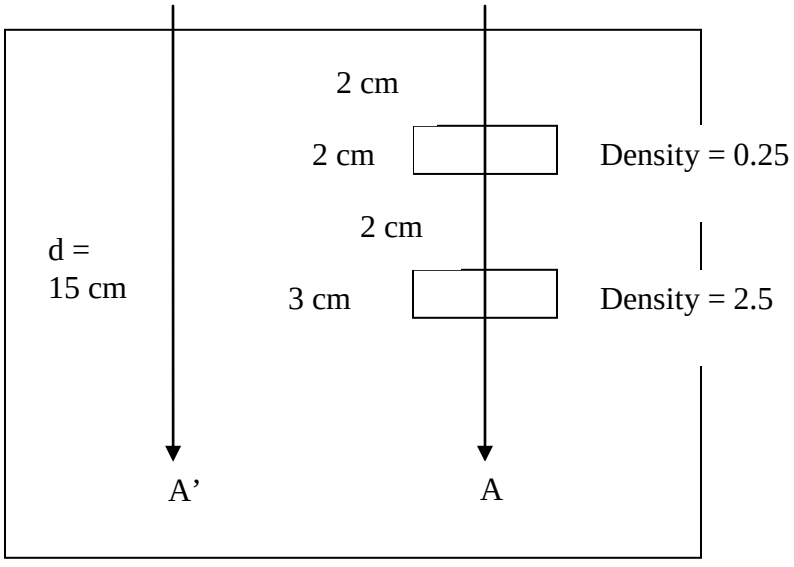
FS	5, 7, 10, 15, 20
OF	
TMR(7cm)	
%dd(7cm)	



22. Point A and B are candidates for machine isocenter. Point C is outside the primary shielding and distances AC(=7m) and BC(=5m) are given. If isocenter is set at A, measurement at C is within the MPD specification. If isocenter is changed to B, how much more shielding (TVL) is needed for the wall to maintain same reading at C, given TVL.



23. From source to point A, there are: 100 cm SSD to surface, then 3 cm tissue, 2 cm inhomogeneity (ρe=0.25), 3 cm tissue, another 3 cm inhomogeneity (ρe=2.5), finally 4 cm tissue. So depth is 15 cm. 4MV beam delivers 200 cGy to point A with inhomogeneities. What's the dose to point A without the inhomogeneities? TMRs were given.



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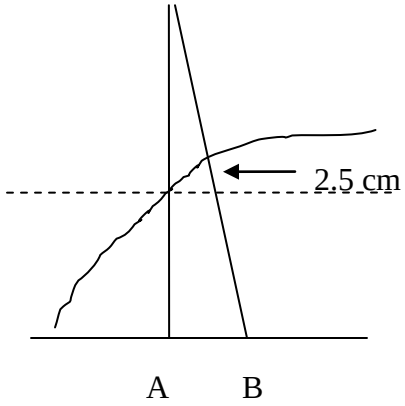
24. Given primary workload, distance to office, and TVL, calculate shielding thickness to achieve 1/10 of MPD. U, T, MPD were not given.

25. If dose to point A (depth 10 cm) is 200 cGy, calculate dose to point B ignore beam divergence. %DD(10)=65%, %DD(12.5)=56%, 100 SSD alone CAX.



26. Lung correction given dose with no correction - the corrected dose has 2 cm of lung and 4 cm of dense medium (4x tissue) - what is the dose at that second point?

27. Orthovoltage shielding calculation given the workload.

28. What would cause the biggest change of the depth of the 80% IDL for a 9 MeV electron? (choices included: add 1 cm bolus, change to 18 MeV, increase FS)

General Observations:

- Shielding questions -- lots of them!
- Lots and lots of dosimetry calculations:
- If you have the PDD or TMR data, how many MUs required?
- Know when to use Mayneord F factor and when to ratio TMRs
- Know relative depth doses for all electrons and photons
- Know definition of terms in TG-51:
- Numerous gap calcs
- Lots of SSD and SAD treatments, max dose, midplane dose.
- One or two, electron beams problems. Not too many. All the fields were rectangle and you had an additional calculation to convert to the equivalent square. TG 51 questions but not difficult. Raphex is very good for the easy questions and Khan and McGinley are good for the others. Lots of practice with the windows calculator. Some problems with long sets of calculations.