放射治療測驗

Radiotherapy

2025年8月24日 星期日

1. 除題意不清楚或是圖片有問題，禁止詢問與試題有關的問題。
2. 應答時禁止使用任何文件。
3. 請在電腦答案卡上圈選作答

項目	**填寫內容**
姓名	您的中文與英文姓名
試題名稱	RT Test
項目	不用填寫
科目	不用填寫
受試者識別代碼	您的准考證號碼後五碼：24XXX 將您選定之數字的圓圈塗滿。
科目代碼	不用填寫
地點代碼	不用填寫
作答方式	本測驗共有89題問題。請使用1到89作答欄位。 請將測驗卷Q1的答案填入答案卷的答案選擇1。Q2 = 答案選擇2，Q3 = 答案選擇3…Q89 = 答案選擇89。

1. Which of the following statements about Dose Volume Histogram (DVH) is correct?
   (A) Optimizes radiation therapy over a certain period of time.
   (B) It is one of the qualitative dose analysis methods in treatment planning.
   (C) It can be used as a quantitative value of the dose delivered to normal tissue.
   (D) The dose to the tumor can be confirmed with a circular graph.
   (E) It is not possible to identify areas of excessive dose to any tissue.

2. Which of the following is a correct for Linear Accelerator Daily Quality Assurance (Daily QA)?
   (A) Electron cone interlock
   (B) Couch position indicator
   (C) Crosshair centering check
   (D) Optical Distance Indicator (ODI)
   (E) Crosshair alignment according to collimator rotation

3. Which of the following statements about radiation quantities and units is correct?
   (A) Kerma is used for indirectly ionizing radiation.
   (B) Exposure dose is used for directly ionizing radiation.
   (C) Equivalent dose is the dose applying tissue weighting factors.
   (D) Radioactivity refers to the rate of decay of atomic nuclei.
   (E) Absorbed dose is used for radiation protection purposes.

4. Which of the following is a correct method to reduce geometric penumbra?
   (A) Fabricate the shielding block with straight shape.
   (B) Increase the source-to-skin distance.
   (C) Increase the source-to-collimator distance.
   (D) Increase the collimator-to-skin distance.
   (E) Use MLC instead of custom shielding blocks.

5.Which of the following statements about isodose curves is correct?
   (A) They are not used in treatment planning prescriptions.
   (B) The beam quality does not need to be consistent when drawing isodose curves.
   (C) They are curves connecting points with the same percentage of depth dose.
   (D) Film isodose curve plotters mainly use non-tissue-equivalent solid materials.

6. If the workload increases by 4 hours, what is the change in Half Value Layer (HVL) to maintain the same shielding design criteria?
   (A) Increase by a factor of 1
   (B) Increase by a factor of 2
   (C) Increase by a factor of 4
   (D) Decrease by 1/2
   (E) Decrease by 1/4

7. Which of the following statements about wedge filters is correct?
   (A) The wedge angle is defined the same way for both physical and virtual wedges.
   (B) The wedge factor of a physical wedge varies significantly depending on field size, depth, and lateral distance.

(C) The wedge angle corresponds to the water-equivalent thickness used for conversion.
(D) The wedge angle is defined by the angle of the wedge's lateral dose profile measured at 10 cm depth in water.
(E) Due to electron contamination in wedge filters, surface dose increases the skin dose to more than 50% of Dmax.

8. Which of the following statements about MLC (Multi-Leaf Collimator) used in IMRT is correct?
(A) MLCs are made of brass to reduce unnecessary penumbra.
(B) The maximum field size of binary MLCs used in tomotherapy is 40×40 cm^2.
(C) The MLC speed changes depending on the beam direction and weight to optimize the dose distribution.
(D) To minimize the tongue-and-groove effect, as few beams as possible should be used.
(E) A double-focused MLC is used for intensity-modulated radiation therapy (IMRT) with sliding window technique.

9. Which of the following statements about the oxygen enhancement ratio (OER) is correct?
(A) High LET radiation has a high OER.
(B) High-energy photon beams have a high OER.
(C) Alpha particles have a higher OER than neutron beams.
(D) As the biological effectiveness ratio increases, the OER also increases.
(E) OER is higher in radiosensitive cell cycle phases.

10. Which of the following statements about proton therapy is correct?
(A) Shielding materials are made of tungsten and lead alloy.
(B) The advantage of proton therapy is maximized for tumors located at the surface.
(C) Proton beams' RBE is 3, showing superior biological effectiveness compared to photons.
(D) The Bragg peak of proton beams is the same across all energies, providing excellent normal tissue protection.
(E) In intensity-modulated proton therapy (IMPT), treatment can be done without the use of compensators and apertures.

11.Which of the following statements about artifacts in CT simulation is correct?
(A) Beam hardening is a physically caused artifact.
(B) Beam hardening decreases as object thickness increases.
(C) Capping occurs if peripheral CT values are higher than central CT values.
(D) Cupping occurs if central CT values are higher than peripheral CT values.
(E) To reduce beam hardening artifacts, use thinner slices or lower tube voltage.

12. Which of the following items requires absolute dose measurement in linear accelerator QA?
(A) Wedge factor measurement
(B) Radiation symmetry measurement
(C) Monthly output dose measurement
(D) Photon output stability depending on dose rate

(E) Photon output stability depending on dose

13. Which item in linear accelerator QA is used to check MLC positional accuracy?
(A) Winston-Lutz
(B) Picket fence
(C) Optimization
(D) Star-shot
(E) Split field

14. Which of the following is correct regarding absolute photon dose measurement?
(A) It can only be measured with detectors calibrated by a standard institution.
(B) Monthly and yearly absolute dose measurements must use different detectors.
(C) The calibration interval of detectors by standard institutions varies depending on detector characteristics.
(D) Farmer-type ionization chambers are commonly used, but diode detectors are generally preferred.
(E) If the ion chamber is calibrated with Co-60, a cross-calibration procedure is required for photon beam use due to beam quality differences.

15. What is the appropriate tolerance for source position accuracy in daily QA of brachytherapy?
(A) 0.5 mm
(B) 1.0 mm
(C) 1.5 mm
(D) 2.0 mm
(E) 2.5 mm

16. Which of the following should be considered in 4D CT simulation?
(A) Inhomogeneity correction of the target
(B) Inhomogeneity dose correction of the target
(C) Intensity modulation of the radiation source
(D) Motion due to respiration
(E) Shortening of treatment time

17.Which of the following is correct regarding ViewRay machine that uses MRI images in recent clinical applications?
(A) The intensity of magnetic field is 3.5T.
(B) Radiation therapy is performed using three Co-60 sources.
(C) The maximum field size is 40×40 cm^2.
(D) SAD (Source-Axis Distance) is 120 cm.
(E) Linear accelerator-based systems use electron beams and photon energies of 6MV and 15MV.

18. Which of the following factors changes the Tissue Maximum Ratio (TMR)?
(A) Energy, SAD, depth
(B) SAD, depth, field size
(C) Energy, depth, field size
(D) Energy, dose rate, field size
(E) SAD, energy, field size

19. What is the main purpose of removing the flattening filter (FFF) in a linear accelerator?
(A) Increase dose rate
(B) Decrease energy
(C) Increase energy
(D) Increase modulation capability
(E) Reduce shielding wall thickness

20. In small field beams (e.g., 4×4 cm^2), why does the dose decrease if the beam pass through air cavity and then enter the tissue?
(A) Scattering stops in the air cavity.
(B) Radiation is absorbed in the air cavity.
(C) Backscatter occurs in the air cavity.
(D) Rebuild-up occurs at the boundary between the air cavity and tissue.
(E) Radiation is attenuated in the air cavity.

21. Which of the following statements about the Window Width (WW) in CT simulation is correct?
(A) If the window width is extremely narrow, the image appears with clear black and white contrast.
(B) The larger the window width, the narrower the range of CT values displayed.
(C) The smaller the window width, the broader the range of CT values displayed on the monitor.
(D) A wider window width results in a higher contrast image and improved resolution.
(E) A narrower window width results in lower contrast and reduces the penumbra in the image.

22. Which of the following is most closely related to respiratory-gated radiotherapy (RGRT)?
(A) SBRT
(B) SRS
(C) 4DCT
(D) DRR
(E) VMAT

23. Which of the following is least related to the CT simulation process?
(A) Isocenter is absolutely necessary.
(B) Generate Portal images.
(C) It is a preparation step for virtual simulation.
(D) A CT scanner is required.
(E) Patient marking is necessary.

24. Among the factors affecting late effects caused by radiation, which is the most important?
(A) Dose rate
(B) Dose per fraction
(C) Total treatment duration
(D) Interval between fractions
(E) Number of fractions

25. Which of the following factors are associated with skin erythema?
A. Beam quality
B. Total dose
C. Field size
D. Dose per fraction
(A) D
(B) A, D
(C) B, D
(D) A, B, C
(E) A, B, C, D

26. What is the most appropriate radiation dose quantity for evaluating exposure when a radioactive substance is absorbed into the body and remains in an organ for a long time without being excreted?
(A) Exposure dose
(B) Absorbed dose
(C) Equivalent dose
(D) Effective dose
(E) Committed dose

27. Which of the following is correct about radiation therapy for liver cancer?
(A) Resection is difficult in multifocal liver cancer.
(B) Liver cancer is classified as a highly radiosensitive tumor.
(C) When treating the hepatic hilum, the duodenum is a critical dose-limiting organ.
(D) Radiation therapy is not performed if TACE (Transarterial chemoembolization) is ineffective.
(E) After radiation therapy, the first change is the increase in LDH (lactate dehydrogenase) levels

28. Which of the following statements about nasal cavity lymphoma is correct?
(A) NK/T-cell type is common.
(B) Neck lymph node involvement is less than 50%.
(C) It occurs more frequently in over 60 years old people.
(D) Local invasion is very rare.
(E) It is more common in Western countries such as the U.S. and Europe.

29. When is PSA nadir (the lowest point) typically observed after prostate radiation therapy?
(A) 1 month
(B) 3 months
(C) 6 months
(D) 9 months
(E) 12 months

30. When treatment duration is long and fractionation is applied, which of the 4 R’s of radiobiology are grouped as positive factors enhancing tumor cell killing?
(A) Redistribution, Repopulation
(B) Repopulation, Reoxygenation

(C) Redistribution, Reoxygenation
(D) Repair, Repopulation
(E) Repair, Redistribution

31. Which of the following is a correct explanation regarding quality assurance (QA) of radiation therapy equipment?
(A) It is conducted in the presence of the safety manager.
(B) It is conducted by engineers from the equipment manufacturer.
(C) It is intended to prepare for regular inspections and random audits.
(D) Each item is checked during actual patient treatment.
(E) QA is divided into daily, monthly, and annual inspections.

32. Why is paraffin applied to the surface of a lead shield during radiation therapy to the eyelid?
(A) Due to the curvature of the lens
(B) To block scattered radiation from the lead shield
(C) To shield neutrons generated from the lead shield
(D) Due to characteristic X-rays generated by X-rays
(E) Due to bremsstrahlung X-rays generated by X-rays

33. Which of the following is correct regarding proton therapy?
(A) Protons, which have about 1,800 times the mass of electrons, are accelerated to about 60% the speed of light for treatment.
(B) Unlike adults, children are more sensitive to the side effects of proton therapy, so it is generally not used for pediatric cancers.
(C) Due to the physical properties of proton therapy, it requires a minimum beam generation time, making respiratory-gated therapy difficult.
(D) Of the passive method (wobbling) and the active method (scanning), IMPT (Intensity Modulated Proton Therapy) uses passive method (wobbling).
(E) The Bragg Peak refers to the phenomenon where the proton beam delivers uniform energy from the point of entry to the end of the tumor and then disappears.

34. Which is the most common primary cancer that metastasizes to the brain?
(A) Lung cancer
(B) Colorectal cancer
(C) Kidney cancer
(D) Breast cancer
(E) Melanoma

35. Which of the following is correct regarding Stereotactic Body Radiotherapy (SBRT)?
(A) Lower MU is needed to deliver the same dose compared to IMRT.
(B) Due to differing RBE values, SBRT with proton is impossible.
(C) Compared to general 3D CRT, more uniform doses can be delivered to the target.
(D) A specially designed stereotactic frame is used to achieve precision similar to SRS.
(E) Fewer treatment sessions with higher total doses are the goal compared to general 3D CRT.

36. Which of the following is a radioprotector?
(A) Amifostine
(B) Metronidazole
(C) Tirapazamide
(D) NBTXR3
(E) Nimorazole

37. What is a benefit of Remote After-Loading Brachytherapy?
(A) Long half-life of radioactive isotopes used
(B) Reduced radiation exposure to staff involved in treatment
(C) High gamma-ray energy
(D) Better prognosis
(E) Reduced patient discomfort

38. What is the absorbed dose in the body from KV cone beam CT?
(A) 0.01–0.4 mGy
(B) 0.1–4 mGy
(C) 1–40 mGy
(D) 10–400 mGy
(E) 100–4000 mGy

39. Which photon beam energy has the smallest penumbra?
(A) Co-60
(B) 6 MV
(C) 10 MV
(D) 15 MV
(E) 18 MV

40. According to AAPM TG-142, which CBCT QA item should be performed daily?
(A) Dose
(B) Contrast
(C) Spatial resolution
(D) Uniformity and noise
(E) Comparison of KV/MV source central axis

41. What is the purpose of using a beam spoiler during Total Body Irradiation (TBI)?
(A) Remove secondary electrons
(B) Increase skin dose
(C) Reduce total dose
(D) Increase dose
(E) Reduce hot spots

42. What is the peak operating power of a klystron used in high-energy linear accelerators (10–25 MeV)?
(A) 1 MW
(B) 2 MW
(C) 3 MW
(D) 5 MW
(E) 10 MW

43. Which of the following is correct about Tomotherapy?
(A) Cone-beam CT using MV energy is possible
(B) Ring type gantry rotates 360 degrees around the patient to deliver the beam
(C) Intensity-modulated radiation therapy (IMRT) using 6 MV and 15 MV energy is possible
(D) Can obtain 3D images and perform real-time image-guided radiation therapy
(E) Uses a robot-based couch to correct patient position from all directions

44. Which of the following is most correct about Field in Field (FIF) Technique?
(A) Has a high dose gradient
(B) Improves conformity
(C) Uses inverse planning and fluence optimization
(D) Increases MU, causing hot spots on the chest wall
(E) Improves dose homogeneity without wedges

45. What is the most appropriate technique to simultaneously treat multiple spinal metastases at C6, T10, and L3?
(A) IMRT
(B) Tomotherapy
(C) SBRT
(D) VMAT
(E) CyberKnife

46. What imaging technique is used for range verification in proton therapy?
(A) CBCT
(B) MRI
(C) PET
(D) MVCT
(E) Ultrasound

47. Which cancer shows the best treatment effect when combining external beam and brachytherapy?
(A) Ovarian cancer
(B) Cervical cancer
(C) Brain tumor
(D) Lung cancer
(E) Esophageal cancer

48. Which of the following is true regarding Total Body Irradiation (TBI)?
(A) Performed before and after bone marrow transplantation
(B) Uses electron beams
(C) Delivers a single high dose for maximum effect
(D) Performed in Stanford position
(E) Uses beam spoiler to control skin dose

49. What is the typical surface dose percentage by energy level in electron beam therapy?
(A) <30%
(B) 30–60%

(C) 50–75%
(D) 75–95%
(E) 95–100%

50. What is the typical MV-CBCT dose to the isocenter in a pelvic treatment patient?
(A) 0.01 cGy
(B) 0.1 cGy
(C) 1 cGy
(D) 10 cGy
(E) 100 cGy

51. PET imaging is formed by acquiring two _____ emitted in opposite directions.
(A) Electrons
(B) Photons
(C) Protons
(D) Positrons
(E) Neutrons

52. In which of the following scenarios is the nurse expected to receive the highest radiation exposure?
(A) A patient undergoing simulation CT
(B) A patient receiving external beam therapy with photon beams
(C) A patient receiving external beam therapy with electron beams
(D) A patient receiving brachytherapy with RAS (Remote After loading System)
(E) A patient receiving I-131 radionuclide therapy

53. According to the NCRP 160 report, radiation exposure in Americans doubled from 1980 to 2006. What was the biggest contributor?
(A) Exposure to radon
(B) Nuclear accidents
(C) Increase in environmental radiation
(D) Increase in medical imaging procedures
(E) Increase in radiation workers

54. If the tumor is located 3.5 cm deep, what is the approximate electron beam energy (MeV) for the 90% isodose line to reach it?
(A) 6 MeV
(B) 9 MeV
(C) 12 MeV
(D) 15 MeV
(E) 18 MeV

55. The collimator size is defined by the width and height of the field at the _____.
(A) Patient's entrance point
(B) Patient's exit point
(C) Isocenter
(D) Linear accelerator jaw head
(E) Linear accelerator MLC head

56. What is the typical rate of energy loss (MeV/cm) of electrons in water within the clinical energy range?
(A) 0.5 MeV/cm
(B) 1.0 MeV/cm
(C) 2.0 MeV/cm
(D) 3.0 MeV/cm
(E) 4.0 MeV/cm

57. In IMRT, which of the following contributes the most to the target dose from collimator leakage and scatter?
(A) Leaf transmission
(B) Transmission from leaf edge curvature
(C) X-ray jaw
(D) Head scatter
(E) Collimator position

58. Why are I-125 and Pd-103 commonly used in prostate seed implants?
(A) They are less expensive than alternatives
(B) Their high anisotropy protects structures above and below the implant
(C) Smaller source size allows greater flexibility in placement
(D) Reduced radiation safety concerns
(E) Lower energies reduce dose to surrounding critical structures

59. What is a valid description of CTDI (Computed Tomography Dose Index)?
(A) The maximum allowable axial dose in a full CT scan
(B) The dose in free space required to generate a single slice
(C) The surface-to-axis dose ratio in a full scan
(D) The total dose accumulated at a point in a single slice during the scan
(E) The dose at a single point along the z-axis during the entire CT scan

60. Which is true about neutrons generated during high-energy (>10 MV) X-ray therapy?
(A) Electron beams generate more neutrons than X-rays
(B) Neutron dose equivalence along the central axis is about 0.5% of X-rays, and about 0.1% outside the field
(C) Neutron contribution increases after multiple scattering from walls and floors
(D) Concrete walls for X-ray shielding are sufficient; additional neutron shielding at the door is unnecessary
(E) The energy spectrum of X-ray–generated neutrons is similar to the uranium fission spectrum in the 10 MeV range.

61. According to AAPM TG-40, how often should X-ray output consistency be verified?
(A) Daily
(B) Weekly
(C) Twice weekly
(D) Monthly
(E) Yearly

62. What is the average transmission dose through MLCs in IMRT?

(A) 0.1%
(B) 1%
(C) 2%
(D) 3%
(E) 5%

63. When applying a small margin to a target volume, what should be considered during treatment?
(A) Patient is well immobilized, so no extra considerations are needed
(B) Since the patient is aware of the treatment, proceed under normal conditions
(C) Small margins do not affect setup accuracy, so no additional action is needed
(D) All factors are considered during planning, so no change in patient setup is necessary
(E) Greater care is needed in patient setup due to reduced margin and increased setup sensitivity

64. Which of the following best describes the process of acquiring CT images synchronized with the patient's breathing phase?
(A) 3-Phase CT
(B) CBCT
(C) 4DCT
(D) RPM System
(E) Dynamic CT

65. Which statement about radiobiology is correct?
(A) Over two-thirds of DNA damage from X-rays occurs through direct action
(B) Longer intervals between sublethal radiation doses increase cell death
(C) Cell cycle reassortment between fractions helps protect normal tissues
(D) Tumor cells repopulate better than normal cells between fractions
(E) Tumor reoxygenation between fractions increases tumor cell kill

66. Which statements are correct about brachytherapy?
A. Enables localized treatment and is easier than surgery
B. Uses sealed sources placed close to the treatment site
C. Fluoroscopy allows accurate positioning with minimal normal tissue damage
D. HDR involves high initial and maintenance costs
E. Fractionated treatment avoids radiation exposure from imaging
(A) A, B, C
(B) A, C, E
(C) C, D, E
(D) A, C, D
(E) A, B, D

67. Which is the correct SI unit used in CT dose reports?
(A) Bq
(B) Sievert (Sv)
(C) rem
(D) Gray (Gy)
(E) C/kg

68. How long does it take for a 1 GBq dose of I-131 to decay to 250 MBq? (Half-life = 8 days)
(A) 8 days
(B) 16 days
(C) 25 days
(D) 32 days
(E) 50 days

69. Which statement is correct regarding SSD and SAD factors?
(A) If SSD + dm = calibration condition, SSD factor > 1
(B) When calibrated at SSD and treated at SAD, SAD factor < 1
(C) If SAD = 80 cm and calibrated at SCD = 100.5 cm, SAD factor < 1
(D) When calibrated at SAD and treated at SSD, SSD factor < 1
(E) In isocentric calibration, SCD and SAD differ

70. What can be measured using the Bragg-Gray cavity theory?
(A) Exposure dose
(B) Absorbed dose
(C) Air dose
(D) Effective dose
(E) Equivalent dose
(F)

71. What is the unit of kerma (Kinetic Energy Released per unit in material, Kerma)?
(A) Gy
(B) R
(C) Sv
(D) rad
(E) eV

72. What is the acceptable error tolerance for cross-hair centering?
(A) 1 mm
(B) 2 mm
(C) 3 mm
(D) 1%
(E) 2%

73. Where is the anatomical location of the Ovoid used in brachytherapy for cervical cancer (ICR)?
(A) Vagina
(B) Cervix
(C) Endometrium
(D) Vaginal fornix
(E) Ovary

74. Which of the following is not a yearly CT quality assurance test item?
(A) Comparison between measured and actual image values
(B) Clinical image evaluation
(C) CT number linearity
(D) Patient radiation dose measurement
(E) Accuracy of localization images

75. Which CT scan parameter affects CT numbers?
(A) kVp
(B) Pitch
(C) mAs
(D) Rotation time
(E) FOV

76. What is an advantage of MVCT over KVCT in in-room imaging devices?
(A) Better visibility of internal markers
(B) Lower patient dose
(C) More artifacts from high-Z materials
(D) Better soft tissue contrast
(E) Imaging uses the same isocenter as the treatment unit

77. What is the main purpose of using a Dose Modification Factor in radiation therapy?
(A) Prevent malfunction of equipment
(B) Control dose variation during treatment
(C) Predict patient treatment response
(D) Develop personalized treatment plans
(E) Adjust total dose delivered to the patient

78. Why are high-energy photon beams used in pelvic treatments?
(A) To reduce neutron dose
(B) To use higher dose rates
(C) To reduce high-dose regions at the beam entrance
(D) To reduce treatment field size
(E) To reduce MLC transmission

79. Which dosimeter is suitable for calibrating high-energy photon beams?
(A) Cutie Pie survey meter
(B) Parallel-plate ion chamber
(C) Silicon diode
(D) Thimble-type ion chamber
(E) Farmer-type ion chamber

80. What is the correct purpose of TNM classification?
(A) To determine operability.
(B) To establish an accurate treatment plan.
(C) To precisely predict treatment outcomes.
(D) To prevent further tumor progression.
(E) To stop metastasis to other organ

81. Which of the following is a correct statement about the characteristics of CyberKnife treatment?
(A) It uses high energy above 15 MV to treat deeper tumors.
(B) It uses a frame system, allowing for precise stereotactic radiosurgery.
(C) It includes an onboard imager (OBI) for acquiring CBCT images and performing IMRT.

(D) It is a non-isocentric treatment system, allowing irradiation from various angles.
(E) It can treat large areas such as craniospinal irradiation (CSI) more quickly.

82. During radiation delivery using a linear accelerator, which photon-matter interaction occurs with the highest probability?
(A) Rayleigh scattering
(B) Photoelectric effect
(C) Compton effect
(D) Pair production
(E) Photodisintegration

83. Which of the following is the correct sequence in 3D image-based brachytherapy planning?
(A) Source dwelling → Applicator modeling → Optimization → Dose evaluation
(B) Source dwelling → Optimization → Applicator modeling → Dose evaluation
(C) Optimization → Applicator modeling → Source dwelling → Dose evaluation
(D) Optimization → Source dwelling → Applicator modeling → Dose evaluation
(E) Applicator modeling → Source dwelling → Optimization → Dose evaluation

84. Which of the following is the correct index used to evaluate dose uniformity in radiation therapy? 5
(A) TCP (Tumor Control Probability)
(B) NTCP (Normal Tissue Complication Probability)
(C) DVH (Dose Volume Histogram)
(D) OAR (Organ At Risk)
(E) HI (Homogeneity Index)

85. Which of the following is a correct description of the Halcyon (O-ring LINAC)?
(A) Uses Binary MLC (Multi-Leaf Collimator)
(B) Allows precise treatment with a 6D couch
(C) Uses MLC leaves with 2.5 mm width, suitable for high-precision treatments like SRS
(D) Reduces low-dose areas using Jaw Tracking
(E) Offers faster gantry rotation than C-arm LINACs, optimized for VMAT (Volumetric Modulated Arc Therapy)

86. In proton therapy, how does the penumbra of the proton beam change as the treatment depth increases?
(A) Increases
(B) Decreases
(C) Stays the same
(D) Cannot be determined with this information alone
(E) Gradually decreases

87. What is the most appropriate device to measure surface dose in electron beam therapy?
(A) Cylindrical ionization chamber
(B) Parallel-plate ionization chamber
(C) Survey meter

(D) Radiochromic film
(E) MOSFET detector

88. Which anatomical area should be considered when making compensators for bilateral total body irradiation?
(A) Hair
(B) Fingernails
(C) Eyes
(D) Nose
(E) Lungs

89. Choose the correct statement related to head and neck cancer:
(A) In oropharyngeal cancer caused by HPV (human papillomavirus), the prognosis is better than in non-HPV-related cases.
(B) Head and neck cancer is unrelated to alcohol consumption.
(C) Head and neck cancers show low FDG uptake, so PET-CT is not useful for staging.
(D) Pre-radiation dental evaluation is only necessary in some selected patients.
(E) Salivary gland dysfunction after radiation therapy is an acute side effect and usually resolves within 3 months.