放射治療測驗

Radiotherapy

2024 年 8 月 24 日星期六

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 24XXX 請填寫准考證後 5 碼，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 74 題問題。請使用 1 到 74 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…Q74 = 答案選擇 74。

1. Which of the following is true about Quality Assurance (QA) of Linear Accelerator?

A. X-ray symmetry constancy: ± 3%
B. X-ray flatness constancy: ± 3%
C. Laser localization: 3mm
D. Crosshair centering: 3mm diameter
E. Light/Radiation field coincidence: ± 3mm

2. Which of the following is required QA after replacement of magratron and target in Tomotherapy?

A. Beam quality
B. image noise
C. MLC twist
D. Image contrast
E. Geometrical errors

3. Which of the following is correct about the Planning Target Volume (PTV) margin which is generated from Clinical Target Volume (CTV)?

A. PTV margin depends on the accuracy of the fused CT image.
B. PTV margin is applied equally to IMRT and 3D conformal therapy.
C. PTV margin is applied equally regardless of Energy (Electron, Photon, Proton)
D. IMRT uses smaller PTV margin than 3D conformal therapy due to the dose optimization method.
E. IMRT can apply smaller PTV margin than 3D conformal therapy as it uses image guided radiation therapy.

4. Which of the following is correct when high energy radiation is exposed to the skin?

A. Ulcer
B. Blister
C. Hair loss
D. Erythema
E. Carcinogenesis

5. Malignant tumor in non-epithelial tissue such as muscle, bone and cartilage is?

A. Adenocarcinoma
B. Carcinoma
C. Sarcoma
D. Small cell carcinoma
E. Squamous cell carcinoma

6. Which of following is correct about OER(Oxygen Enhancement Ratio) that affect to the radiation sensitivity?

A. The high-LET radiation has high OER.
B. High energy photon has high OER
C. α particle has higher OER than Neutron
D. OER increases with increasing RBE
E. OER is high at the most radiosensitive cell cycle

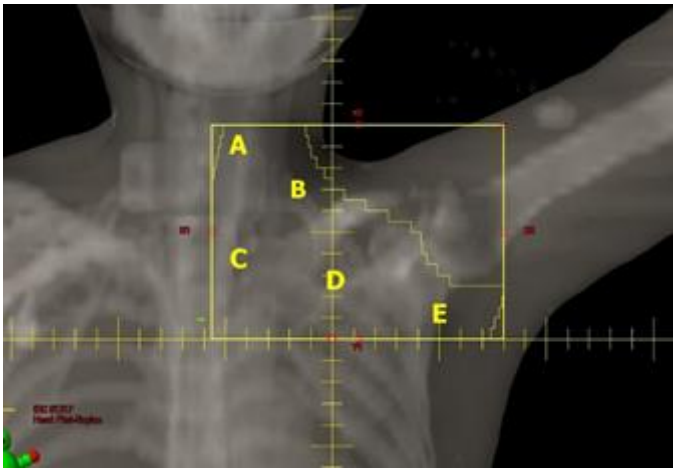
7. Fractionated radiotherapy enhances the therapeutic ratio as the cell redistribution. Which of the following is the factor enhancing therapeutic ratio?

A. Cell cycle
B. Temperature effect
C. Oxygen Enhancement Ratio
D. Linear Energy Transfer
E. Relative Biological Effeteness

8. Which of the following is correct about the correlation of LET, OER and RBE?

A. Increases LET up to 100 keV/μ, RBE increases and OER decreases.
B. Increases LET up to 100 keV/μ, RBE increases and OER increases
C. Increases LET up to 100 keV/μ, RBE decreases and OER increases
D. Decreases LET from 100 keV/μ, RBE increases and OER decreases
E. Decreases LET from 100 keV/μ, RBE decreases and OER decreases

9. Which is the axillary lymph node level 2 on the image below?



A. A
B. B
C. C
D. D
E. E

10. Which of following is correct about the MLC Quality Assurance?

A. Picket fence test evaluates the relative positional accuracy
B. Accuracy would be improved if each leaf has evaluated.
C. It can be evaluated by EPID with the measurement of penumbra of 10x10 ㎠.
D. Compare Light and Radiation field coincidence with Light field and Radiochromic film
E. It can be evaluated by radiation field size measurement data from 3D water phantom

11. Which of the following is the most appropriate chamber for the measurement of Photon/Electron profile with water phantom on monthly QA?

A. Free air ionization chamber
B. Farmer type chamber
C. Radiochromic film
D. Plane parallel plate
E. 0.125cc thimble chamber

12. Which of the following is correct about the evaluation of electron beam quality?

A. Measure with Plane parallel plate.
B. Measure with solid water phantom according to the depth.
C. D-max should not be the measurement point like photon.
D. Annual QA is conducted with a tolerance of 1mm based on a depth dose percentage of 80%.
E. Monthly QA is conducted with a tolerance of 1mm / 1% based on a depth dose percentage of 50%.

13. Which of the following is correct about the picture below?

A. Verification imaging can be performed immediately before treatment
B. Isodose curves can be directly marked on the film
C. The same energy conditions as the actual radiotherapy machine are used
D. It cannot be used for monitoring progress or outcomes after radiotherapy has started.
E. It is an imaging device that matches the geometric conditions of the radiotherapy machine.

14. Which is the correct about the picture below?

A. Determination of staging
B. 3D images acquisition
C. Prediction of treatment outcomes and prognosis
D. Calculation of patient's treatment dose
E. Acquisition of accurate fluoroscopic information

15. What should be considered in 4D CT simulation?

A. Inhomogeneity correction of the target
B. Inhomogeneity correction of the target
C. Intensity modulation of the source
D. Respiratory gating
E. Reduction of treatment time

16. Choose the reason why eyeball shielding device with wax coated is used?

A. Because of the curvature of the lens
B. To block scattered radiation from the lead shield
C. To shield neutrons generated by the lead shield
D. Due to characteristic X-rays generated by the X-ray
E. Due to bremsstrahlung X-rays generated by the X-ray

17. Which of following is the biggest volume of irradiated volume in Prostate cancer (Prostate only)?

A. AP/PA
B. 4 box techniques
C. 7 field 3DCRT
D. 7 field IMRT
E. 2 Arc VMAT

18. Regarding proton therapy, the RBE (Relative Biological Effectiveness) correction dose is used based on Co-60. Which of the following statements is correct?

A. Protons bind better to DNA, resulting in greater biological effects.
B. The LET (Linear Energy Transfer) of protons is higher than X-rays, making them 1.1 times more biologically toxic.
C. The beam energy of protons is higher than X-rays, resulting in different biological effects.
D. The size of proton particles is larger than X-rays (photons), leading to better cell destruction.
E. Proton therapy produces more radioactive isotopes, causing additional effects on cells.

19. Which of the following treatment devices is expected to have the largest penumbra during SBRT (Stereotactic Body Radiation Therapy) or SRS (Stereotactic Radiosurgery) treatment?

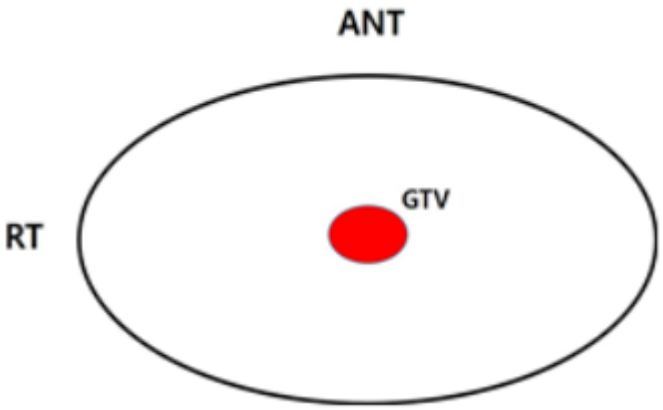
A. Cyberknife
B. Tomotherapy
C. Gamma knife
D. Novalis(BrainLAB)
E. TrueBeam(Varian), Versa HD(Elekta)

20. Which of the following lists arranges in descending order of equivalent dose when delivering the same absorbed dose (1 Gy)?

A. Proton machine B. Carbon ion machine C. 6 MV photon machine D. Cobalt machine E. Electron machine

① A>B=C>D>E
② A>B>C=D>E
③ B>A>C=D=E
④ B>A>C=D>E
⑤ B=A>C=D=E

21. Which of the following treatment methods results in the lowest integral dose when planning treatment as shown



in the image?

A. 180-degree ARC

B. Opposing 2-field irradiation (AP & PA)

C. Opposing 2-field irradiation (Rt. lat & Lt. lat)

D. 4-field irradiation (AP & PA & Rt. lat & Lt. lat)

E. 4-field irradiation (4 oblique)

22. Which of the following statements about surface dose is correct?

A. Proton beams are higher than electron beams.
B. It decreases as the energy of the electron beam increases.
C. It decreases as the field size increases.
D. Surface dose is independent of energy and is influenced by forward scattering.
E. It increases as the incident angle increases in oblique incidence.

23. The correct statement regarding radiation-induced mutations is:

A. It is more prevalent in recessive than in dominant.

B. It is safe for gonadal doses of 10 Gy or less.

C. Radiation-induced carcinogenesis is a type of somatic cell mutation.

D. To prevent genetic abnormalities, it is recommended not to conceive for 6 months to 1 year.

A. A
B. A, B
C. C, D
D. A, B, C
E. A, B, C, D

24. What are the standard measurement conditions for temperature and pressure when measuring output dose for quality control?

A. Temperature: 20°C, Pressure: 740 mmHg
B. Temperature: 20°C, Pressure: 760 mmHg
C. Temperature: 22°C, Pressure: 740 mmHg
D. Temperature: 22°C, Pressure: 760 mmHg
E. Temperature: 22°C, Pressure: 780 mmHg

25. The crucial factor determining the response rate and survival rate in radiation therapy for spinal cord compression due to tumors is:

A. Histological type of the primary tumor

B. The range of spinal cord compression

C. The location of spinal cord compression

D. Overall performance status before surgery

E. Ambulatory status before surgery

26. Which statement is the most accurate description of radiation therapy for keloids?

A. Deliver 10-15 Gy, 2-5 fraction.
B. The effectiveness of radiation therapy is the same before and after surgery.
C. Radiation therapy begins 72 hours after surgery.
D. The radiation treatment field allows for a margin of at least 2 cm around the suture line
E. Local injection of corticosteroids is recommended considering patient convenience

27. Which type of ionizing radiation uses indirect effects in radiation therapy?

A. Alpha, X-ray, Gamma
B. X-ray, Gamma, Proton
C. X-ray, Gamma, Neutron
D. Proton, Neutron, X-ray
E. Alpha, Proton, Neutron

28. The dose distribution profile of high-energy X-ray devices such as linear accelerators should be managed within a difference of how many percent during monthly checks? What is the correct tolerance for this management error?

A. 1%
B. 2%
C. 3%
D. 4%
E. 5%

29. When measuring the beam flatness of a linear accelerator, which type of phantom is most suitable?

A. Human phantom
B. Solid phantom
C. Acryl phantom
D. Water phantom
E. Air equivalent phantom

30. Which of the following is radiation induced acute syndrome?

A. Cancer
B. Blistering
C. Cataract
D. Radiation sickness
E. Genetic effects

31. Which of the following is correct about Acceptance test?

A. verifies whether the diametric and mechanical measurements meet the values specified in the specifications.
B. It is not necessary to strictly adhere to the specifications requested by the acceptor depending on the situation.
C. Acceptance testing is solely for acceptance testing and can be adjusted as needed in the future.
D. Treatment of patients can proceed even if the device is not within the specified absolute allowable range.
E. Performs the input of beam data and modeling necessary for the measurement treatment planning equipment.

32. Which of the following is the daily QA checklist?

A. X-ray flatness
B. X-ray symmetry
C. Door
D. Light/Radiation field coincidence
E. Alignment of Crosshair Center with Collimator Rotation

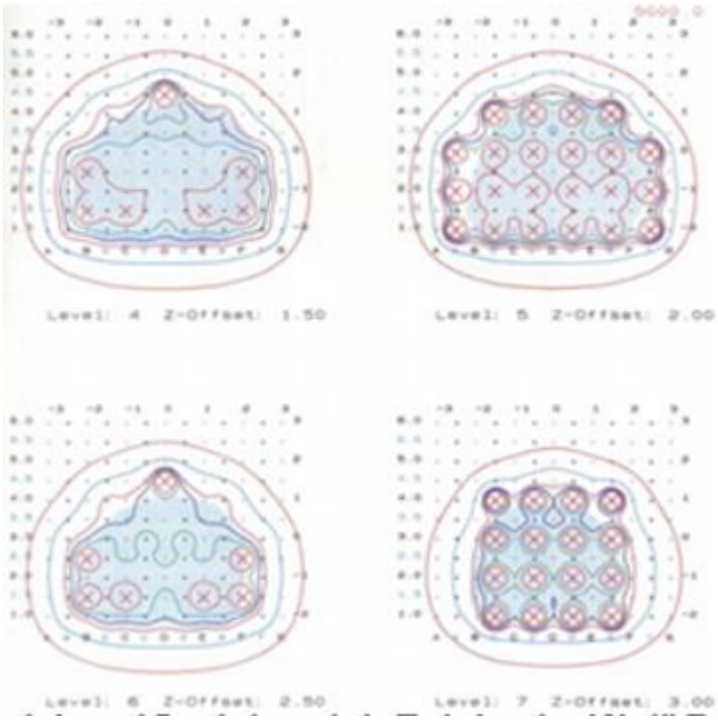
33. Which of the following is the Monthly QA checklist?

A. photon beam profile constancy
B. X-ray flatness change
C. X-ray symmetry change
D. X-ray monitor unit linearity
E. Gantry rotation isocenter

34. Which of the following statements about Hyper fractionation radiotherapy is true?

A. The total irradiation dose is reduced
B. A single dose is 180 to 200 cGy
C. The single dose is 500-600 cGy
D. The total dose and duration of treatment decreases.
E. Total irradiation dose increases, but treatment duration and chronic complications do not increase.

35. The diagram below shows the nuclide array and dose distribution for brachytherapy of a site. Which of the following is the correct pairing of the site, nuclide, and treatment method?



A. Prostate- Ir-192-(semi)permanent implantation
B. Prostate- Ir-192-Internal Irradiation
C. Prostate- I-125-(semi)permanent implantation
D. Uterine Cancer- Ir-192-Intracavitary Irradiation
E. Uterine cancer- I-125-Intracavitary irradiation

36. Which of the following is the maximum dose limit (as a percentage of the total therapeutic dose) for pacemakers as defined by AAPM Task Group report 34?
A. 0.1 Gy or less
B. 0.2 Gy or less
C. 1.0 Gy or less
D. 2.0 Gy or less
E. No dose limit

37. Which of the following statements about proton therapy methods is true about passive scattering and active scanning?
A. Passive scattering has a smaller physical penumbra than active scanning.
B. Passive scattering is mainly used for Intensity Modulated Proton Therapy (IMPT).
C. The Active Scanning method uses a compensator to adjust the Bragg Peak distance and generates SOBP according to the patient.
D. The advantage of the Passive Scattering method over the Active Scanning method is that there is less unnecessary dose at the tumor proximal side.
E. Active Scanning method generally shows a similar dose distribution shape of the distal side of the tumor and the proximal side of the tumor (Concave&Concave or Convex&Convex).

38. Which of the following is a characteristic of full-scan mode compared to half-scan mode for cone beam CT?
A. Contrast is better.
B. Better spatial resolution
C. Large image acquisition area.
D. Energy selection is possible.
E. Low dose for image acquisition

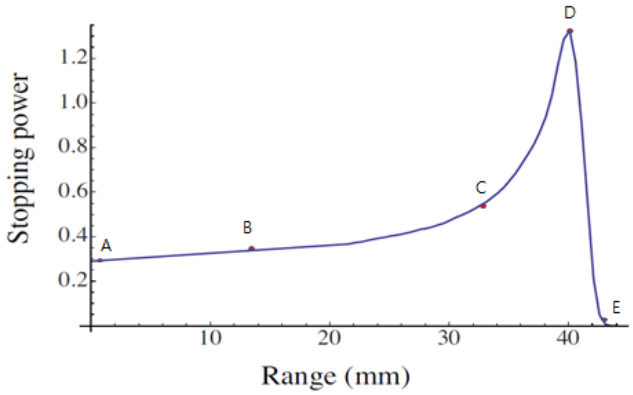
39. What phenomena can be caused by irregular breathing during phase-based 4D-CT image acquisition?
A. Ring artifact
B. Loss of image information in the area
C. Blurred image
D. Image acquisition of discontinuous slice
E. Additional patient dose

40. What is the term used to describe the probability of normal organ adverse complications in adjacent organs (OAR) due to the dose distribution of irradiation?
A. TCP
B. BED
C. EUD
D. EQD
E. NTCP

41. Which of the following is a parenthesis?
The Hounsfield units (HU) and electron density obtained from a CT simulator depend on ( ) and are independent of ( ).
A. kVp, mAs
B. kVp, filter
C. mAs, KvP
D. mAs, filter
E. filter, kVp

42. Why is accurate measurement of CT number important for treatment planning after simulation CT installation?
A. To ensure the accuracy of image fusion with MRI images
B. To ensure high contrast and resolution of CT images
C. To accurately calculate the patient's exposure dose during CT image acquisition
D. To calculate accurate dose considering the unevenness of tissues in the human body
E. To display accurate body contour of treatment areas and major organs in CT images

43. In the following figure, which proton beam has the lowest energy and highest biological effectiveness ratio?



A. A
B. B
C. C
D. D
E. E

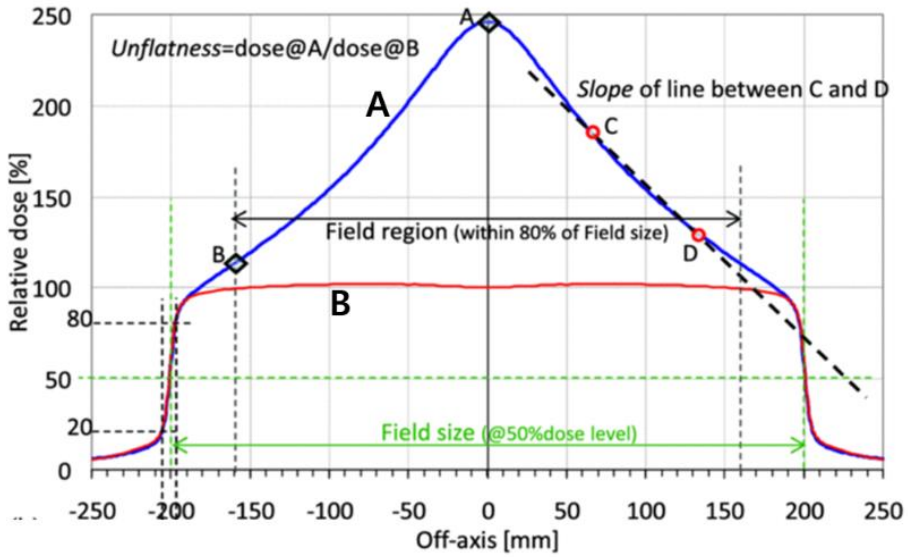
44. Which of the following factor should be considered important for a CT simulator compared to a diagnostic CT?
A. Dose
B. Scan speed
C. Image noise
D. Field uniformity
E. Electron density to CT number conversion

45. Why is a 15 cm long circular cone used in stereotactic radiosurgery (SRS) with linear accelerator (LINAC)?
A. To match the shape of the tumor
B. To minimize geometric penumbra
C. To increase the skin-to-surface distance (SSD)
D. To prevent collision between patient and machine
E. To maximize the rotation angle in non-coherent plane therapy

46. Which statement is true about the Mayneord F factor, which is applied to the variation of SSD values in two-dimensional radiation therapy planning?
A. The larger the irradiation surface, the smaller the margin of error.
B. The margin of error increases for changes in small SSD..
C. It is effective for small irradiation surfaces with minimal scatter.
D. Significant errors can occur at high energies.
E. In general, the Mayneord F factor underestimates the increase in the percentage deep dose with increasing SSD.

47. For a patient with multiple bone metastases in the 6th cervical, 10th thoracic, and 3rd lumbar vertebrae, which of the following treatment modalities would be most appropriate for simultaneous treatment of all 3 sites?
A. Intensity modulated radiation therapy (IMRT)
B. Tomotherapy
C. Stereotactic body radiation therapy (SBRT)
D. *Volumetric modulated arc therapy* (VMAT)
E. CyberKnife

48. The following shows the lateral beam profile (beam profile) of 6MV photons generated from a linear accelerator. Which of those is correct about the characteristics of each A and B?



A. A is the beam profile without a flattening filter, and it has the disadvantage of a longer treatment time.
B. B is an energy that can only be applied to 3D radiotherapy.
C. A uses high output to achieve high-dose-rate treatment in IMRT.
D. B can deliver a more uniform dose to the tumor than A.
E. Wedge filters can be used to improve the output value of B.

49. Which of the following is determined during the CT simulation process in radiation therapy?

A. Option 1: Determination of treatment goals
B. Option 2: Determination of the number of treatment fields
C. Option 3: Determination of treatment technique
D. Option 4: DOSE-VOLUME-HISTOGRAM (DVH) evaluation
E. Option 5: Fabrication of immobilization devices

50. Which ionization chamber is suitable for dose measurement in the orthovoltage range?

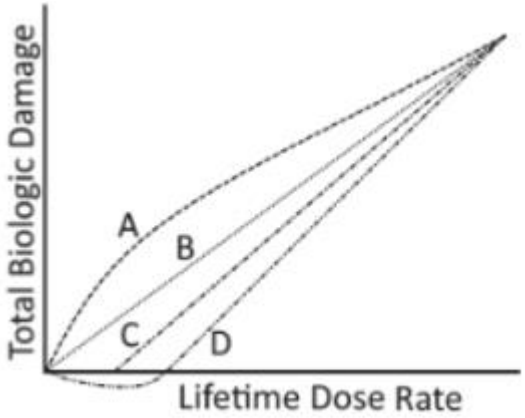
A. Option 1: Farmer type chamber
B. Option 2: Extrapolation chamber
C. Option 3: Any type of ionization chamber
D. Option 4: Well type ionization chamber
E. Option 5: Free Air Ionization chamber

51. Which image acquisition technique provides the best soft tissue contrast?

Options:

A. Option 1: kV fluoroscopy
B. Option 2: kV radiography
C. Option 3: kV cone-beam CT (CBCT)
D. Option 4: MV portal imaging
E. Option 5: All soft tissue contrast techniques are similar.

52. Which curve among the curves in the figure below represents the linear model without a threshold for radiation damage?



A. A
B. B
C. C
D. D
E. None of above

53. What is the isocenter alignment tolerance for SRS/SBRT according to AAPM TG-142?

A. Option 1: 0.25 mm
B. Option 2: 0.5 mm
C. Option 3: 1 mm
D. Option 4: 1.5 mm
E. Option 5: 2 mm

54. What is the main advantage of FFF (flattening filter free) beams?

Options:

A. Option 1: Reduced surface dose
B. Option 2: Shorter treatment time
C. Option 3: Significantly increased MU values
D. Option 4: Increased scatter radiation in the head area
E. Option 5: Much easier beam modeling in the treatment planning system

55. Which radiation type and energy range does the AAPM TG-51 protocol recommend using parallel-plate ion chambers for?

Options:

A. Option 1: Photon beams, < 6 MV
B. Option 2: Photon beams, < 10 MV
C. Option 3: Electron beams, < 6 MeV
D. Option 4: Electron beams, < 9 MeV
E. Option 5: Electron beams, < 12 MeV

56. Which of the following factors affect the geometrical penumbra in radiation therapy?

A. Option 1: Source diameter, source-to-collimator distance (SDD), source-to-surface distance (SSD)
B. Option 2: Source-to-collimator distance (SDD), source-to-surface distance (SSD), collimator material
C. Option 3: Source-to-surface distance (SSD), collimator material, detector performance
D. Option 4: Collimator material, detector performance, source diameter
E. Option 5: Detector performance, source-to-collimator distance (SDD), source-to-surface distance (SSD)

57. When using a small margin for the target volume in radiation therapy, which of the following should be considered for the patient's treatment?

A. Option 1: The patient is accurately immobilized during treatment, so no further consideration is necessary.
B. Option 2: The patient is informed about the treatment and is treated under the same conditions as usual.
C. Option 3: The small target volume range does not affect the accuracy of patient setup, so no further consideration is necessary.
D. Option 4: Since everything has been considered in the treatment planning stage, the patient is set up in the same way as before.
E. Option 5: Since the smaller margin setting for the target volume can lead to reduced accuracy due to patient setup inconsistencies, the patient should be set up and treated with greater care.

58. What is the minimum distance an accessory should be from the patient to prevent electron contamination in radiation therapy?

A. Option 1: 2 cm
B. Option 2: 5 cm
C. Option 3: 10 cm
D. Option 4: 15 cm
E. Option 5: 30 cm

59. What are the possible causes of field light misalignment in radiation therapy?

Options:

A. Option 1: Mirror misalignment
B. Option 2: Gantry angle discrepancy
C. Option 3: Primary collimator misalignment
D. Option 4: Ion chamber misalignment
E. Option 5: Flattening filter misalignment

60. What are the main purposes of a radiation therapy simulator?

A. Option 1: To obtain isodose curves
B. Option 2: To calculate beam divergence
C. Option 3: To calculate the thickness of blocks required for shielding
D. Option 4: To verify the placement of blocks
E. Option 5: To evaluate the dose of the treatment plan

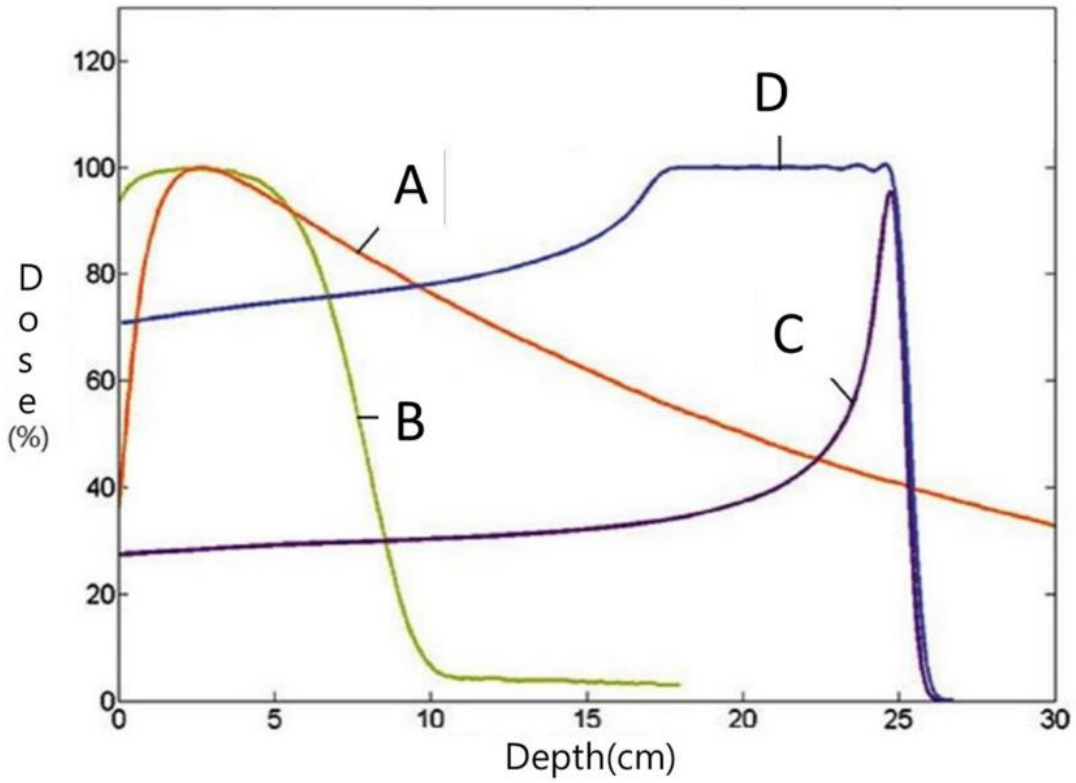
61. What is the average relative biological effectiveness (RBE) of protons used in clinical radiation therapy?

A. Option 1: 1.0
B. Option 2: 1.1
C. Option 3: 1.5
D. Option 4: 2.0
E. Option 5: 3.0

62. Which of the following equations correctly describes the relationship between tissue maximum ratio (TMR) and tissue-air ratio (TAR)?

A. Option 1: TMR = TAR / scatter-tissue ratio (SMR)
B. Option 2: TMR = TAR * SMR
C. Option 3: TMR = TAR * maximum scatter factor (PSF)
D. Option 4: TMR = TAR / PSF
E. Option 5: TMR = TAR * scatter-air ratio (SAF)

63. Which of the following statements is correct regarding the images below?



A. (A) is mainly used for the treatment of superficial tumors.
B. (B) decreases skin dose as energy increases.
C. (C) shows the dose distribution generated by electron beams of 25 MeV or higher.
D. (D) is created through a Range Modulation Wheel or Ridge Filter.
E. (A), (B), (C), and (D) are radiation energies that can be generated by the latest linear accelerators.

64. What are the goals of radiation therapy for the next patient?
A 53-year-old female patient with no prior medical history presented with vaginal bleeding as the main symptom that occurred 3 months ago. A 5 cm cervical mass was found on physical examination and squamous cell carcinoma was diagnosed on biopsy. Lymph node metastasis in the pelvis was also found, and FIGO stage IIIC1r was confirmed. The patient is planning to undergo concurrent chemoradiotherapy (external beam radiation therapy followed by intracavitary brachytherapy).

A. Definitive
B. Salvage
C. Palliative
D. Consolidation
E. Prophylactic

65. Which of the following is an accurate description of brachytherapy?
A. It allows for focused treatment and is easier than surgery.
B. It uses non-sealed radiation sources and treats the treatment area closely.
C. It can be visualized for position confirmation and has high accuracy, resulting in minimal normal tissue damage.
D. For HDR, there are initial investment and maintenance costs.
E. For fractionated irradiation, there is no exposure to radiation through fluoroscopy.

A. A, B, C
B. A, C, D
C. C, D, E
D. A, C, D
E. A, B, D

66. Which of the following artifacts are caused by the hardware of a CT simulation machine?

A. Streak artifact
B. Motion artifact
C. Metal artifact
D. Photon starvation artifact
E. Ring artifact

67. Which of the following is an example of abnormal cell proliferation?

A. Edema
B. Neoplasm
C. Hematoma
D. Extravasation
E. Sepsis

68. Which of the following treatment methods utilizes the forward planning technique?

A. IMRT
B. VMAT
C. SBRT
D. Tomotherapy
E. 3D conformal

69. Which of the following viruses is known to cause nasopharyngeal cancer (NPC)?

A. hepatitis B
B. hepatitis C
C. Epstein-Barr virus
D. Human papiloma virus, HPV
E. human immunodeficiency virus, HIV

70. In a CT simulator, what is the appropriate electrical hardware that detects X-ray signals, converts the output light signals into analog electrical signals, amplifies them, and then converts them into digital information using an ADC?

A. Power distribution unit
B. Data acquisition system
C. Image processing system
D. Filtered back projection system
E. Scintillation crystal photodiode detecter

71. What is the most commonly used reconstruction technique among the reconstruction techniques used in CT simulators?

A. Back projection
B. Filtered back projection
C. Matrix inversion method
D. Iterative approximation method
E. Fourier transformation reconstrucition

72. Which of the following is not a one-year inspection item for CT quality control?

A. Clinical Image Evaluation
B. CT Number Linearity
C. Patient Dosimetry Test
D. Scout Image Accuracy Test
E. Comparison of Measured Values in Images with Actual Measurements

73. Which of the following is the most appropriate explanation for respiratory artifacts that can occur during 4D CT imaging for respiratory-gated radiotherapy?

A. Applying a short scan time or increasing the pitch can reduce it.
B. It occurs in the direction that coincides with the rays of the first and last views
C. It occurs due to insufficient elimination of blurring during the Back Projection process.
D. It occurs more frequently when the patient's breathing is slow..
E. It occurs more frequently when the patient's breathing is fast.

74. Which of the following is the correct explanation of relative biological effectiveness (RBE)?

A. LET and RBE are inversely proportional.
B. RBE is the highest around LET of 100keV/μm.
C. The biological effect of reference X-rays (250kV) is considered to be 2.
D. As LET increases, RBE continues to increase exponentially.
E. It is intended to compare the biological effects of different radiation types with the same LET.