1. The caudal margin of the target volume in patients with endometrial carcinoma is:
   A. Anterior superior iliac spine
   B. Brim of true pelvis
   C. Midobturator foramen
   D. Widest point of the bony pelvis

2. Which of the following tissue will most likely require a homogeneity correction factor of .25 gmcc?
   A. Liver
   B. Lung
   C. Breast tissue
   D. Bone tissue

3. The target volume for malignancies of the nasopharynx must include all or part of:
   1. Base of the skull
   2. Cervical lymph nodes
   3. Supraclavicular lymph nodes
   A. 1 & 2 only
   B. 1 & 3 only
   C. 2 & 3 only
   D. 1, 2, & 3

4. During rotation therapies with an arc angle of 100 degrees, the point of maximum dose is normally located:
   A. On the isocenter
   B. Displaced toward the irradiated sector
   C. Displaced away from the irradiated sector
   D. At depth of Dmax

5. During radiotherapy of the rectum custom shield blocks for the lateral wedged field are designed to reduce irradiation of the:
   1. Sacrum
   2. Urinary bladder
   3. Prostate gland
   A. 1 & 2 only
   B. 1 & 3 only
   C. 2 & 3 only
   D. 1, 2, & 3

6. Preservation of reproductive function when high pelvic irradiation is unavoidable can be accomplished by:
   1. External organ shields
   2. Internal organ shields
   3. Surgical relocation of the gonads
   A. 1 only
   B. 2 only
   C. 3 only
   D. 1, 2, & 3

7. The mass attenuation coefficient for a 10 MeV photon beam will be highest for:
   A. Water
   B. Blood
   C. Bone
   D. Soft tissue

8. What is the geometric penumbra for a 2.0cm diameter source at a 80cm source-to-surface distance (SSD) and a 40cm source diaphragm distance (SDD) at a depth of 10 cm?
   A. 1.09
   B. 1.25
   C. 2.50
   D. 3.75

9. The amount of geometric penumbra is not effected by the:
   A. Source skin distance
   B. Source diaphragm distance
   C. Field size
   D. Source size

10. Tumors that are limited to the upper cervical esophagus are best treated with:
    A. A single field treatment
    B. AP/PA opposed port
    C. Three field technique with posterior obliques
    D. 360 degree rotation
11. Target volume for carcinoma of the uterine cervix and endometrium includes the _______.

1. Uterus  
2. Upper vagina  
3. Regional nodes

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

12. Which of the following are advantages of parallel opposed fields:

1. Homogeneous tumor dose  
2. Setup reproducibility  
3. Less chance of geometric miss

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

13. In order to maximize tumor dose and minimize dose to the surrounding tissue, which of the following can be considered.

1. Use appropriate field size  
2. Increase number of portals  
3. Use appropriate beam energy

A. 1 only  
B. 2 only  
C. 3 only  
D. 1, 2, & 3

14. The half value layer thickness for a 10MeV photon energy is about:

A. 1 mmAl  
B. 1 mmCu  
C. 13 mmPb  
D. 13 mmI2O

15. The use of shielding blocks will require dose calculations involving:

1. Depth  
2. Blocked field  
3. Unblocked field

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

16. A treatment in which the source-axis distance (SAD) remains constant at all times is referred to as a/an:

A. Split field technique  
B. Mangle technique  
C. Hypobaric technique  
D. Isocentric technique

17. Which of the following may lead to treatment errors. Incorrect data concerning:

1. Energy of unit  
2. Tumor depth  
3. Tumor dose

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

18. The tilting of an isodose curve from its normal position is best accomplished by the use of:

A. Flattening filters  
B. Wedge filters  
C. Bolus materials  
D. Build up blocks

19. What is the hinge angle for a 30 degree wedge?

A. 60 degrees  
B. 100 degrees  
C. 120 degrees  
D. 150 degrees

20. Calculate the equivalent square for a 10cm x 15cm rectangular field.

A. 11.1cm x 11.1cm  
B. 12cm x 12cm  
C. 13cm x 13cm  
D. 14cm x 14cm

21. An area outside the target area which receives a higher dose than the specified target does is termed a:

A. Tolerance sport  
B. Hot spot  
C. Cold spot  
D. Threshold spot

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22. Which of the following may lead to errors in treatment?

1. **Illegible handwriting**  
2. **Miscalculation of time**  
3. **Not noting prescription change**

A. 1 & 2 only  
B. 1 & 3 only  
C. 2, & 3 only  
D. 1, 2, & 3

23. In order to obtain accurate measurements of patient dosimetry, which of the following factors must be considered?

1. **Target depth**  
2. **Body contours**  
3. **Tissue density**

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

24. The prescription for treatment should include all of the following EXCEPT:

A. Energy of the unit  
B. Total dose planned  
C. Monitor units given  
D. Depth of tumor

25. To maintain a surface dose of less than 50% with a Cobalt beam, an air gap of at least ______ is required.

A. 3cm  
B. 5cm  
C. 12cm  
D. 15cm

26. The dose distribution data measured by a water phantom closely approximates the radiation absorption and scattering properties of:

1. **Bone tissue**  
2. **Muscle tissue**  
3. **Soft tissue**

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

27. The most desirable feature of a wedge pair technique is a ______ beyond the overlap region.

1. **Rapid dose build-up**  
2. **Rapid dose fall off**  
3. **Uniform dose distribution**

A. 1 only  
B. 2 only  
C. 3 only  
D. 1, 2, & 3

28. Radiotherapy treatment simulation is used for:

1. **Determination of patient position**  
2. **Checking accuracy of block placement**  
3. **Delineate of treatment field**

A. 1 & 2 only  
B. 1 & 3 only  
C. 2, & 3 only  
D. 1, 2, & 3

29. Whenever possible, patient immobilization should be performed in the:

A. Prone position  
B. Supine position  
C. Lateral position  
D. Oblique position

30. The optimum hinge angle for a 60 degree wedge pair is:

A. 30 degrees  
B. 45 degrees  
C. 60 degrees  
D. 90 degrees

31. The process that converts ultrasound energy from electrical energy and vice-versa is the:

A. Auger effect  
B. Modulation transfer effect  
C. Piezoelectric effect  
D. Van de Graf effect
32. The rationale behind using lower than the 100 percent isodose curve for irradiation of the chest wall using an electron beam is:
   1. Increased skin sparing  2. Lower lung exposure  3. Reduced bolus use
   A. 1 only  B. 2 only  C. 3 only  D. 1, 2, & 3

33. Irregular fields dose calculations can be done by using the _______ method.
   1. SSD  2. Clarkson  3. TMR
   A. 1 only  B. 2 only  C. 3 only  D. 1, 2, & 3

34. One of the weakest links in the treatment planning process is:
   A. Patient positioning  B. Isocentric technique  C. Simulation  D. Localization

35. For a Cobalt 60 unit, as the prescription depth increases:
   1. The surface dose increases  2. The tumor dose increases  3. The applied dose increases
   A. 1 & 2 only  B. 1 & 3 only  C. 2 & 3 only  D. 1, 2, & 3

36. Direct calculation of absorbed dose from a given exposure may not be used:
   1. For photon energies above 3 MeV  2. Where electronic equilibrium does not exist  3. For electron beams
   A. 1 & 2 only  B. 1 & 3 only  C. 2 & 3 only  D. 1, 2, & 3

37. What is the principal advantage of isocentric technique over SSD technique for a treatment with multiple ports?
   A. Depth of tumor is known  B. Laser lights are easily used  C. Patient is not moved  D. Field size is defined on the skin

38. The tumor, presumed tumor and normal surrounding tissues enclosed by the minimum target dose isodose surface is called the:
   A. Maximum target volume  B. Mean target volume  C. Treatment volume  D. Minimum target volume

39. One or more serious problem(s) when a treatment field is inaccurately aligned are:
   1. Underdose to normal tissue  2. Abnormal beam profile  3. Failure to treat entire tumor
   A. 1 only  B. 2 only  C. 3 only  D. 1, 2, & 3

40. Ultrasound provides useful information for patient contours of the following structures, except:
   A. Retroperitoneum  B. Lung tissue  C. Chest wall  D. Breast

41. What is the angle between the central axis of two beams called?
   A. Hinge angle  B. Overlap angle  C. Block angle  D. Wedge angle
52. When treating to a depth of 5 cm using partial arc therapy, the isocenter should be:
   A. 1.5 cm  
   B. 2.5 cm  
   C. 5.0 cm  
   D. 7.0 cm

53. A record of treatment is contained within the:
   A. Flow chart  
   B. Patient log book  
   C. Treatment chart  
   D. Simulation chart

54. For a sloping skin surface, isodose curves are not perpendicular to the direction of the beam. The skin sparing effect can be maintained and the situation corrected by using (a):
   A. Bolus  
   B. Multi-field techniques  
   C. Shielding blocks  
   D. Compensating wedge filter

55. During a given treatment, a 10 gram tumor receives a uniform dose of 400 rads. The total energy absorbed by this tissue is:
   A. $4 \times 10^3$ ergs  
   B. $6 \times 10^3$ ergs  
   C. $8 \times 10^3$ ergs  
   D. $4 \times 10^4$ ergs

56. The use of lymphangiography is an important part of a diagnostic workup for:
   A. Vaginal tumors  
   B. Testicular tumors  
   C. Breast tumors  
   D. Brain tumors

57. The strongest amount of echo reflection in an ultrasonic imaging system occurs for which tissue interface?
   1. Muscle - fat  
   2. Soft tissue - fat  
   3. Soft tissue - bone
   A. 1 only  
   B. 2 only  
   C. 3 only  
   D. 1, 2, & 3

58. Which of the following is a commonly employed method of tumor localization?
   1. Palpation  
   2. C.T. scanning  
   3. Radiography
   A. 1 & 2 only  
   B. 1 & 3 only  
   C. 2 & 3 only  
   D. 1, 2, & 3

59. When using shielding blocks, which of the following is effected?
   A. Equivalent square  
   B. S.S.D.  
   C. S.T.D.  
   D. S.A.D.

60. The wedge used during the external beam irradiation of the larynx is employed to:
   A. Increase skin dose  
   B. Evenly distribute dose  
   C. Reduce skin dose  
   D. Reduce backscattering

61. The treatment chart contains information as to:
   1. Type of cancer  
   2. Record of treatment given  
   3. Description of treatment position
   A. 1 & 2 only  
   B. 1 & 3 only  
   C. 2 & 3 only  
   D. 1, 2, & 3

62. Determine the equivalent square for a rectangular field with a width of 7 cm and a length of 17 cm.
   A. 9.1  
   B. 9.9  
   C. 10.9  
   D. 11.6
63. Determine the equivalent square for a rectangular field with a width of 8cm and a length of 15cm.  
A. 8.2  
B. 8.5  
C. 9.5  
D. 10.4

64. The intensity of a high energy photon beam at any given distance from the source is:  
A. Directly proportional to the distance  
B. Inversely proportional to the square of the distance  
C. Directly proportional to the square of the distance  
D. Inversely proportional to the distance

65. Air and contrast mixture may be introduced into the urinary bladder to:  
A. Help minimize the effects of irradiations  
B. Provide an internal bolus  
C. Assist in the localization of the bladder  
D. Increase the target dose

66. Which of the following types of treatment machines use a source to skin distance of 50cm or more?  
1. Superficial  
2. Orthovoltage  
3. Megavoltage  
A. 1 only  
B. 2 only  
C. 3 only  
D. 1, 2, & 3

67. Which of the following is used to localize the target volume of the prostate?  
1. Ultrasound  
2. Orthogonal radiography  
3. Stereoradiography  
A. 1 only  
B. 2 only  
C. 3 only  
D. 1, 2, & 3

68. The treatment prescription should define the:  
1. Treatment volume  
2. Tumor dose  
3. Number of treatments  
A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

69. One of the principal reasons that the treatment volume must be larger than the tumor volume is related to:  
1. Movement due to respiration  
2. Swelling caused by previous treatments  
3. Possible microscopic extensions  
A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

70. In the _______ range of photon energies film has been used to measure isodose curves with acceptable accuracy of ± 3%.  
A. 100 kV  
B. 250 kV  
C. 500 kV  
D. 4 MV

71. The use of "negative" shield blocks are most commonly employed for treating tumors of the:  
A. Lung  
B. Abdomen  
C. Head and neck  
D. Shoulder

72. Calculate the equivalent square for 8x12cm rectangular field:  
A. 8.4cm x 8.4 cm  
B. 9.6cm x 9.6 cm  
C. 10.2cm x 10.2 cm  
D. 11.6cm x 11.6 cm
73. Hot and cold spots are common problems associated with:

1. Isocentric fields
2. Abutting fields
3. Four field technique

A. 1 only
B. 2 only
C. 3 only
D. 1, 2, & 3

74. Which of the following devices can be used to provide for cross-section image localization of internal structures?

1. Conventional tomography
2. Transverse tomography
3. Computed tomography

A. 1 & 2 only
B. 1 & 3 only
C. 2 & 3 only
D. 1, 2, & 3

75. The advantages of treatment simulations include:

1. Unforeseen problems can be solved
2. Increased treatment room "up" time
3. Improved radiographic quality

A. 1 & 2 only
B. 1 & 3 only
C. 2 & 3 only
D. 1, 2, & 3

76. Which of the following MUST be noted in the treatment chart:

A. Set-up sketch
B. Dose calculation
C. Patient position
D. Patient photograph

77. A lesion is being treated using a 100 degree angle of arc rotation. The midpoint of the tumor volume is 5cm. The isocenter should be placed at:

A. 0.5cm
B. 2.5cm
C. 5cm
D. 7.5cm

78. Two treatment fields on a patient with cancer of maxillary sinus have a hinge angle of 90 degrees. Calculate the wedge angle.

A. 0 degrees
B. 45 degrees
C. 60 degrees
D. 90 degrees

79. During a 4 mV treatment, a sloping skin surface is corrected by a _______ shift toward the skin surface of the isodose curve.

A. 3/4
B. 2/3
C. 1/2
D. 1/4

80. The major advantages of megavoltage irradiation compared to orthovoltage technique include:

1. Higher depth dose
2. Less side scatter
3. Skin sparing

A. 1 & 2 only
B. 1 & 3 only
C. 2 & 3 only
D. 1, 2, & 3

81. The best method for reproducing the large irregular field required in the radiotherapy of a bronchopulmonary lesion is best achieved through the use of:

A. Wedged fields
B. Customized divergent blocks
C. Customized non-divergent blocks
D. Shaped bolus blocks
82. When preparing a treatment chart, which of the following may lead to treatment errors? Incorrect data concerning:

1. Energy of unit
2. Patient respiration
3. Microscopic extensions

A. 1 only
B. 2 only
C. 3 only
D. 1, 2, & 3

83. A 4 MV photon beam is being used at 100cm SAD to treat a lesion using an arc angle of 110 degrees. If the midpoint of the tumor volume is at 5cm, the isocenter should be placed at:

A. 2cm
B. 5cm
C. 7cm
D. 15cm

84. If the exposure rate of the Cobalt treatment machine is increased by 30%, which of the following will increase?

A. Percentage depth dose
B. Tumor dose
C. Backscatter factor
D. All of the above

85. Tumors that are limited to the upper cervical esophagus are first best treated with _______ then to spare the cord, oblique parallel opposed technique can be used:

1. A single field treatment
2. Parallel opposed ports
3. 360 degree rotation

A. 1 only
B. 2 only
C. 3 only
D. 1, 2, & 3

86. Side and ceiling lasers should intersect at a point in the arc corresponding to the:

1. Rotational axis
2. SAD of the machine
3. Isocenter of the unit

A. 1 only
B. 2 only
C. 3 only
D. 1, 2, & 3

87. The target volume for a bronchopulmonary lesion should include:

1. Primary lesion
2. Mediastinum
3. Hilar nodes

A. 1 & 2 only
B. 1 & 3 only
C. 2 & 3 only
D. 1, 2, & 3

88. During localization of the target volume of the prostrate, _______ contrast is often used to locate the bladder and the course of the urethra distal to the bladder

A. Air
B. Nitrogen
C. Iodine contrast media
D. Radium

89. The penetrating power of an x-ray beam can be increased by

A. Increasing the HVL
B. Decreasing the kVp
C. Decreasing tube filtration
D. Increasing the tube current

90. The best non-invasive procedure for the evaluation of tumor response or recurrence after surgery and irradiation for a brain tumor is:

A. Computed tomography
B. Cerebral angiography
C. Ultrasonography
D. Radionuclide scanning

91. The demonstrated tumor and other tissue with presumed tumor is considered the:

A. Target volume
B. Treatment volume
C. Irradiated volume
D. Maximum target volume

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Treatment Planning
92. A patient is treated with two adjacent photon beam fields, 10cm and 12cm in length respectively, at 80 SSD. Calculate the gap on the skin necessary to give a uniform junction at a depth of 13cm.

A. 0.5 cm  
B. 1.2 cm  
C. 1.8 cm  
D. 2.4 cm

93. A computer-based system that compares the treatment that has been set up with a record of the intended treatment is called a:

A. Closed-circuit system  
B. Record and verify system  
C. AFC system  
D. Vacuum system

94. The prescription includes notation of all of the following EXCEPT:

A. Daily dose  
B. Time or minutes  
C. Treatment plan  
D. Total dose to date

95. Which type of treatment will be used for a 2cm source-to-skin distance?

1. Orthovoltage  
2. Contact  
3. Superficial

A. 1 only  
B. 2 only  
C. 3 only  
D. 1, 2, & 3

96. Why does the exposure rate increase as field size increases?

A. Filter flattening  
B. Block transmission  
C. Collimator scattering  
D. Phantom scattering

97. Spectral energies of a heterogeneous beam can best be measured with a:

A. Scintillation spectrometer  
B. Calorimeter  
C. Point source plotter  
D. Dose rate calibrator

98. The magnitude of high dose regions produced in wedge pair techniques will increase as:

1. Field size increases  
2. Wedge angle increases  
3. Depth increases

A. 1 & 2 only  
B. 1 & 3 only  
C. 2 & 3 only  
D. 1, 2, & 3

99. The geometric penumbra of a 2.5cm diameter source at a 100cm SSD and 40cm source-to-diaphragm distance 10cm below the skin surface is:

A. 4.38  
B. 3.45  
C. 2.75  
D. 2.34

100. The ICRU considers the minimum accuracy of the delivered dose to be of the prescribed dose:

A. 20%  
B. 18%  
C. 5%  
D. Any of the above