

पुस्तिका में पृष्ठों की संख्या : 32

Number of Pages in Booklet : 32

पुस्तिका में प्रश्नों की संख्या : 180

No. of Questions in Booklet : 180

प्रश्न-पत्र पुस्तिका संख्या /

Question Paper Booklet No.

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SUBJECT : Radiotherapy

परीक्षा दिनांक :- 11/08/2020

समय : 3.00 घण्टे

Time : 3.00 Hours

परीक्षा समय :- 9:00 To 12:00

अधिकतम अंक : 180

Maximum Marks : 180

प्रश्न-पत्र पुस्तिका एवं उत्तर पत्रक के पेपर सील/पॉलिथिन बैग को खोलने के बाद परीक्षार्थी प्रश्न-पत्र पुस्तिका संख्या को उत्तर पत्रक पर सावधानीपूर्वक अंकित करें। इसमें किसी भी प्रकार की त्रुटि होने पर जिम्मेदारी अभ्यर्थी की होगी।

The candidate fill the Question Paper Booklet No. on Answer Sheet carefully after opening the Paper Seal / Polythene bag. Candidate himself shall be responsible for any error.

परीक्षार्थियों के लिए निर्देश

1. सभी प्रश्नों के उत्तर दीजिए।
2. सभी प्रश्नों के अंक समान हैं।
3. प्रत्येक प्रश्न का केवल एक ही उत्तर दीजिए।
4. एक से अधिक उत्तर देने की दशा में प्रश्न के उत्तर को गलत माना जाएगा।
5. प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं, जिन्हें क्रमशः 1, 2, 3, 4 अंकित किया गया है। अभ्यर्थी को सही उत्तर निर्दिष्ट करते हुए उनमें से केवल एक गोले अथवा बबल को उत्तर पत्रक पर नीले बॉल प्वाइंट पेन से गहरा करना है।
6. OMR उत्तर पत्रक इस परीक्षा पुस्तिका के अन्दर रखा है। जब आपको परीक्षा पुस्तिका खोलने को कहा जाए, तो उत्तर-पत्र निकाल कर ध्यान से केवल नीले बॉल पॉइंट पेन से विवरण भरें।
7. प्रत्येक गलत उत्तर के लिए प्रश्न अंक का 1/3 भाग काटा जायेगा। गलत उत्तर से तात्पर्य अशुद्ध उत्तर अथवा किसी भी प्रश्न के एक से अधिक उत्तर से है। किसी भी प्रश्न से संबंधित गोले या बबल को खाली छोड़ना गलत उत्तर नहीं माना जायेगा।
8. मोबाइल फोन अथवा इलेक्ट्रॉनिक यंत्र का परीक्षा हॉल में प्रयोग पूर्णतया वर्जित है। यदि किसी अभ्यर्थी के पास ऐसी कोई वर्जित सामग्री मिलती है तो उसके विरुद्ध आयोग द्वारा नियमानुसार कार्यवाही की जायेगी।
9. कृपया अपना रोल नम्बर ओ.एम.आर. पत्रक पर सावधानीपूर्वक सही भरें। गलत अथवा अपूर्ण रोल नम्बर भरने पर 5 अंक कुल प्राप्तांकों में से काटे जा सकते हैं।

चेतावनी : अगर कोई अभ्यर्थी नकल करते पकड़ा जाता है या उसके पास से कोई अनधिकृत सामग्री पाई जाती है, तो उस अभ्यर्थी के विरुद्ध पुलिस में प्राथमिकी दर्ज कराते हुए विविध नियमों-प्रावधानों के तहत कार्यवाही की जाएगी। साथ ही विभाग ऐसे अभ्यर्थी को भविष्य में होने वाली विभाग की समस्त परीक्षाओं से विवर्जित कर सकता है।

INSTRUCTIONS FOR CANDIDATES

1. Answer all questions.
2. All questions carry equal marks.
3. Only one answer is to be given for each question.
4. If more than one answers are marked, it would be treated as wrong answer.
5. Each question has four alternative responses marked serially as 1, 2, 3, 4. You have to darken only one circle or bubble indicating the correct answer on the Answer Sheet using BLUE BALL POINT PEN.
6. The OMR Answer Sheet is inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully with blue ball point pen only.
7. 1/3 part of the mark(s) of each question will be deducted for each wrong answer. A wrong answer means an incorrect answer or more than one answers for any question. Leaving all the relevant circles or bubbles of any question blank will not be considered as wrong answer.
8. Mobile Phone or any other electronic gadget in the examination hall is strictly prohibited. A candidate found with any of such objectionable material with him/her will be strictly dealt as per rules.
9. Please correctly fill your Roll Number in O.M.R. Sheet. 5 Marks can be deducted for filling wrong or incomplete Roll Number.

Warning : If a candidate is found copying or if any unauthorized material is found in his/her possession, F.I.R. would be lodged against him/her in the Police Station and he/she would liable to be prosecuted. Department may also debar him/her permanently from all future examinations.

इस परीक्षा पुस्तिका को तब तक न खोलें जब तक कहा न जाए।

Do not open this Test Booklet until you are asked to do so.

09 - □



1. What is the equivalent square field size of a rectangular $10 \times 15 \text{ cm}^2$ field ?
 - (1) $11 \times 11 \text{ cm}^2$
 - (2) $12 \times 12 \text{ cm}^2$
 - (3) $13 \times 13 \text{ cm}^2$
 - (4) $14 \times 14 \text{ cm}^2$

2. What is the primary radiobiological rationale of accelerated hyperfractionation ?
 - (1) Reduce the extent of intra-tumoral hypoxia
 - (2) Reduce the level of acute normal tissue toxicity
 - (3) Diminish the repopulation of tumor cells
 - (4) Decrease late effects while improving tumor control

3. For a cervical brachytherapy implant using the Manchester system, which point should receive the highest dose ?
 - (1) Point A
 - (2) Point B
 - (3) Bladder point
 - (4) Rectum point

4. Charged particle interactions with matter are predominately mediated by which effect ?
 - (1) Photoelectric effect
 - (2) Compton effect
 - (3) Pair production
 - (4) Direct Ionization

5. How many times greater is the mass of a proton compared to an electron ?
 - (1) 20
 - (2) 200
 - (3) 2,000
 - (4) 20,000

6. With a patient in the head-first supine position, an anterior-posterior (AP) beam is delivered on a linear accelerator using International electro-technical Commission (IEC) standards. What is the gantry angle?
 - (1) 0°
 - (2) 90°
 - (3) 180°
 - (4) 270°

7. Which electron energy exhibits the lowest surface dose ?
 - (1) 6 MeV
 - (2) 9 MeV
 - (3) 12 MeV
 - (4) 15 MeV

8. The typical cell cycle time (TC) for proliferating cells in human tumors is in the range of
- (1) <1 day
 - (2) 1-5 days
 - (3) 6-25 days
 - (4) 26-100 days
9. High LET radiation are beneficial over low LET X-rays in treating tumors under which environmental constraint ?
- (1) Hypoxia
 - (2) Hyperthermia
 - (3) High vascularization
 - (4) Low inflammation
10. In ICRU-83, what is the planning organ at risk volume (PRV) ?
- (1) Volume to account for motion of the target to an organ at risk
 - (2) Volume to account for uncertainties and variations in position of a specific organ
 - (3) Volume that delineates the portion of an organ that is most at risk
 - (4) Volume of a parallel organ that is critical for radiation injury
11. What advantage does MV portal imaging offer when compared to kV planar imaging ?
- (1) It allows for better soft tissue contrast for kV portal imaging
 - (2) It delivers a lower imaging dose than kV planar imaging
 - (3) It allows for the visualization of the treatment field with blocking
 - (4) It is uniquely capable of verifying that the patient is setup to isocenter
12. Which linear accelerator head component is necessary when delivering an electron beam ?
- (1) Target
 - (2) Scattering foil
 - (3) Multi-leaf collimator (MLC)
 - (4) Jaw collimators
13. Why more monitor units are typically required for IMRT than for 3D CRT?
- (1) Dose per fraction is typically higher for IMRT than for 3D CRT
 - (2) A higher beam energy is used for IMRT than for 3D CRT
 - (3) IMRT employs more fields than 3D CRT
 - (4) Large portions of the fields are blocked in IMRT compared to 3D CRT

14. What is the principal interaction process of megavoltage X-rays in tissue ?
- (1) Pair production
 - (2) Photoelectric effect
 - (3) Compton effect
 - (4) Coherent scatter
15. Globally, what percent of cancer is estimated to be caused by infections?
- (1) 1-2
 - (2) 5-10
 - (3) 15-20
 - (4) 40-50
16. DNA double strand breaks are repaired by which mechanism ?
- (1) Mismatch repair
 - (2) Base Excision repair
 - (3) Nucleotide Excision Repair
 - (4) Nonhomologous End-Joining
17. Which treatment technique is most demanding on the performance and accuracy of a treatment delivery system ?
- (1) 3D conformal therapy
 - (2) Volumetric-modulated arc therapy
 - (3) Conformal arc therapy
 - (4) Segmental intensity-modulated radiation therapy
18. Which of the following is an advantage of MR imaging over CT imaging ?
- (1) MRI has better geometric accuracy
 - (2) MRI has smaller voxel sizes
 - (3) MRI provides electron density information
 - (4) MRI generates image sets in axial, sagittal, coronal or oblique planes
19. If the energy of an electron beam is increased for a treatment, what happens to the skin dose ?
- (1) Increases
 - (2) Decreases
 - (3) Stays the same
 - (4) Depends on the energies used
20. Which cancer may be treated with radioactive iodine ?
- (1) VIPoma
 - (2) Hurthle cell cancer
 - (3) Medullary thyroid cancer
 - (4) Anaplastic thyroid cancer

21. A multifraction protocol for cancer cells exposed to x-rays produces an effective survival curve that is :
- (1) Linear-quadratic
 - (2) Linear
 - (3) Parabolic
 - (4) Exponential
22. Which of the following match-up concerning radiation units is false ?
- (1) KERMA- Curie
 - (2) Absorbed dose- Gray
 - (3) Exposure-Roentgen
 - (4) Equivalent dose-Sievert
23. An accidental exposure to a radiation source is reported one month following irradiation of a person not wearing a dosimeter. Which of the following assay would represent the best method to estimate the radiation dose received by this person ?
- (1) Alkaline elution
 - (2) Staining with a monoclonal antibody to gamma-H2AX
 - (3) Karyotyping peripheral blood lymphocyte
 - (4) Pulsed-field gel electrophoresis
24. Which of the following research designs are the quickest and least expensive studies to undertake ?
- (1) Clinical Trials
 - (2) Cohort Studies
 - (3) Case Control Studies
 - (4) Cross-Sectional Studies
25. The main cause of death from the hematopoietic syndrome is :
- (1) Hypotension arising from microvascular destruction
 - (2) Haemolytic anemia
 - (3) Infection and haemorrhage resulting from loss of white cells and platelets
 - (4) Loss of erythrocytes resulting in organ ischemia
26. What was the most significant factor associated with secondary sarcoma development after treatment of childhood cancer ?
- (1) Radiation dose
 - (2) Anthracycline exposure
 - (3) Age at treatment
 - (4) Gender

27. A 60-year-old post-menopausal woman has completed adjuvant chemotherapy for a stage II breast cancer. The cancer was ER+, PR+ and her2/neu negative. She had a mastectomy as initial treatment. Which of the following is the most appropriate next step to reduce her risk of recurrence ?

- (1) An aromatase inhibitor for 5 to 10 years
- (2) Tamoxifen for 5 years followed by an aromatase inhibitor for 5 years
- (3) Tamoxifen for 2 years followed by an aromatase inhibitor for 3 years
- (4) Tamoxifen for 5 to 10 years

28. Continuous hyper-fractionated accelerated radiation therapy (CHART) involved all except -

- (1) Short overall treatment time of 12 consecutive days
- (2) Three fractions of radiation per day
- (3) Six day per week radiotherapy
- (4) Low dose per fraction (1.4 – 1.5 Gy)

29. Which of the following is considered a postoperative chemoradiotherapy indication in cervical cancer ?

- (1) Positive surgical margin
- (2) Tumor size >4 cm
- (3) Deep stromal invasion
- (4) Clear cell histology

30. A 71-year-old woman diagnosed with left ovarian mass in pelvic ultrasound. CT abdomen/pelvis reveals left inguinal lymphadenopathy. She undergoes full cytoreductive surgery with left inguinal lymphadenectomy. Pathology is significant for 2.5 cm left ovarian papillary serous carcinoma, implants on the left fallopian tube, one left pelvic lymph node and two left inguinal lymph nodes. What is the stage ?

- (1) II
- (2) I
- (3) IV
- (4) III

31. Optimal treatment strategy for stage II-III soft tissue sarcomas extremity

- (1) Surgery + IORT
- (2) Surgery + adjuvant chemotherapy
- (3) Surgery + chemoradiotherapy
- (4) Preoperative radiotherapy + surgery

32. A 55 year male with oropharyngeal cancer stage T3N2 stage IVa was treated with cisplatin and radiation for 7 weeks. He completed his therapy 12 months ago. Now complains severe fatigue, forgetfulness, dry skin, no sexual drive. He has dry mouth, but he can eat solid food. Which of the following is the most appropriate next step ?
- (1) Order PET/CT scan to rule out brain metastatic disease
 - (2) Check TSH and free T4
 - (3) Explain to patient that this is normal part of the process and he may never feel back to normal
 - (4) Send patient to psychiatrist to evaluate for possible depression.
33. What is the most significant prognostic risk factor regarding early breast cancer ?
- (1) Number of involved regional nodes
 - (2) hormone receptors -Ve
 - (3) High Ki67 proliferation markers
 - (4) Larger initial size
34. Tamoxifen and aromatase inhibitors can be used in the treatment of ER+/PR+ breast cancer. In post-menopausal women, which of the following side-effect profiles would favour the use of tamoxifen over aromatase inhibitors ?
- (1) Fracture risk
 - (2) Hot flushes
 - (3) Vaginal bleeding
 - (4) Uterine cancer
35. Which of the following parameters is not used in the Van Nuys prognostic index ?
- (1) Size
 - (2) Grade
 - (3) Surgical margin
 - (4) Hormone receptor status
36. Which is not a paraneoplastic syndrome associated with small cell Lung Cancer ?
- (1) Ectopic Cushing's syndrome
 - (2) Lambert-Eaton syndrome
 - (3) Sweet's Syndrome
 - (4) Dermatomyositis
37. What was the total preoperative RT dose for initially unresectable vulvar cancer in the GOG 205 study when given along with weekly cisplatin chemotherapy ?
- (1) 45 Gy
 - (2) 50.4 Gy
 - (3) 57.6 Gy
 - (4) 63 Gy

38. According to the RTOG breast cancer contouring atlas, what is included in the chest wall CTV for a patient receiving PMRT ?

- (1) Mastectomy scar and chest wall excluding pectoralis muscles and ribs
- (2) Mastectomy scar and chest wall including pectoralis muscles and excluding ribs
- (3) Mastectomy scar and chest wall including pectoralis muscles and ribs, excluding latissimus dorsi muscle
- (4) Mastectomy scar and chest wall including pectoralis muscles, ribs and latissimus dorsi muscle

39. What is the estimated rate of radionecrosis in modern studies following intracranial radiosurgery alone ?

- (1) 1%
- (2) 5%
- (3) 9%
- (4) 13%

40. What was the difference in 3-year OS between HPV +ve and HPV -ve oropharyngeal cancer patients in the RTOG 0129 trial ?

- (1) 5%
- (2) 25%
- (3) 45%
- (4) 65%

41. Which one of these breast cancer histologies is most favourable outcome?

- (1) Apocrine
- (2) Pleomorphic lobular
- (3) Medullary
- (4) Metaplastic

42. Which patient would be considered "Suitable" for consideration of APBI according to the updates ASTRO consensus statement ?

- (1) 42 yr old, pT1N0 ER positive ILC, 3 mm margins
- (2) 52 yr old, pT1N0 ER positive IDC, 2 mm margins
- (3) 62 yr old, pT1N0 ER negative IDC, 3 mm margins
- (4) 62 yr old, pTis, 1.5 cm, low grade, 2 mm margins

43. What imaging feature is characteristic of a low grade oligodendrogliomas?

- (1) Haemorrhage
- (2) Calcification
- (3) Occipital lobe location
- (4) Ring-enhancement

44. What is hybrid brachytherapy in cervical cancer?
- (1) Interdigitated EBRT and brachytherapy
 - (2) Combination of intracavitary and interstitial source placement
 - (3) Delivery of brachytherapy after EBRT
 - (4) Addition of weekly chemotherapy
45. For locoregionally advanced cancer Nasopharynx, which induction chemotherapy regimen given prior to concurrent chemo-radiotherapy improved OS compared to standard in a randomized controlled Phase III trial?
- (1) Cetuximab
 - (2) Carboplatin and paclitaxel
 - (3) Gemcitabine and cisplatin
 - (4) Carboplatin and 5-fluorouracil
46. For which of the following clinical scenarios would liver SBRT be a recommended treatment?
- (1) Resectable extrahepatic cholangiocarcinoma
 - (2) 7 cm HCC tumor invading the portal vein with Child Pugh A cirrhosis
 - (3) Metastatic rectal cancer with a solitary 5 cm liver metastasis invading the duodenum
 - (4) Metastatic colorectal cancer with 3 subcentimeter liver metastases, and bilateral lung metastases

47. A patient undergoes radical inguinal orchiectomy for an 8 cm right testicular seminoma Pathology showed invasion of rete testes and LVSI; and there was no nodal involvement on scans; serum markers returning to normal levels after surgery. What is the recommended RT technique?
- (1) 30 Gy with right sided “dog leg” field
 - (2) 30 Gy with para-aortic only field
 - (3) 20 Gy with right sided “dog leg” field
 - (4) 20 Gy with para-aortic only field
48. Early Breast Cancer Trialists Collaborative Group (EBCTCG 2014) meta-analysis of post-mastectomy trials, what was the impact of RT in women with 1-3+ nodes who underwent an axillary dissection and received systemic therapy?
- (1) It was detrimental in this population
 - (2) It yielded no benefit
 - (3) It improved locoregional control only
 - (4) It improved locoregional control and breast cancer specific survival

49. In the START B Trial, which endpoint was not superior in the hypofractionation arm ?
- (1) Telangiectasia
 - (2) Breast edema
 - (3) Local recurrence
 - (4) Breast shrinkage
50. In the HD 16 randomized control trial comparing the role of radiotherapy for favourable Hodgkin patients that have negative PET scans (defined as Deuille score <3) after 2 cycles of ABVD, what was the impact of RT ?
- (1) Increased PFS and OS
 - (2) Increased PFS but not OS
 - (3) Increased PFS but decreased OS
 - (4) Increased PFS and OS
51. After definitive chemo-radiation for treatment of anal cancer, what is the minimum length of time (months) to wait before performing a biopsy on a persistent, but responding mass ?
- (1) 1 month
 - (2) 3 months
 - (3) 6 months
 - (4) 12 months
52. For a patient with locally advanced oesophageal cancer endoscopically visualized at 20 cm from the incisors, which of the following diagnostic tests is not indicated ?
- (1) Bronchoscopy
 - (2) Laparoscopy
 - (3) PET-CT
 - (4) Endoscopic ultrasound
53. What was the approximate median OS (years) of patients with 1p19q Co-deleted gliomas following PCV and sequential RT on RTOG 9402 ?
- (1) 5
 - (2) 10
 - (3) 15
 - (4) 20
54. What treatment is recommended for stage IIA squamous cell carcinoma of the vagina ?
- (1) EBRT + brachytherapy
 - (2) Brachytherapy alone
 - (3) Wide local excision
 - (4) Laser ablation

55. What is the most appropriate management for a 37-year-old patient with Stage IA nodular sclerosing Hodgkin lymphoma, non-bulky, involving the right cervical neck, with baseline ESR of 15 and LDH of 200 ?

- (1) ABVD × 2 cycles + no RT
- (2) ABVD × 2 cycles + 20 Gy RT
- (3) ABVD × 4 cycles + 20 Gy RT
- (4) ABVD × 4 cycles + 30 Gy RT

56. What is the recommended prescription dose range when using 1-5 fraction stereotactic radiation to treat functioning pituitary adenomas ?

- (1) 2 - 12 Gy
- (2) 20 - 35 Gy
- (3) 45 - 54 Gy
- (4) 55 - 65 Gy

57. According to the IMRT Contouring guidelines for treating intact cervix squamous cell carcinoma when there is no vaginal involvement, what proportion of the vagina is required to be included in the CTV ?

- (1) 25%
- (2) 50%
- (3) 66%
- (4) 100%

58. Which of the following cranial nerves runs through the cavernous sinus ?

- (1) II
- (2) IV
- (3) V3
- (4) VII

59. What is the approximate anatomical landmark of the renal hilum ?

- (1) T9/T10
- (2) L1/L2
- (3) L3/L4
- (4) L5/S1

60. Appropriate method of therapeutic intensification for the post-operative radiotherapy treatment of inflammatory breast cancer :

- (1) A hypofractionated regimen
- (2) The use of daily bolus
- (3) An axillary boost
- (4) Inclusion of the contralateral IM chain

61. Most appropriate treatment for pT1N2b squamous cell carcinoma of the lateralized oral tongue :

- (1) Radiation therapy with definitive intent
- (2) Induction chemotherapy followed by surgery
- (3) Radiation therapy and concurrent chemotherapy
- (4) Surgery and adjuvant therapy as indicated by pathology

62. Recommended maximum dose to the optic apparatus in single fraction radiosurgery to result in $\leq 1\%$ risk of radiation-induced optic neuropathy per NTCP modelling :

- (1) 7 Gy
- (2) 10 Gy
- (3) 12 Gy
- (4) 15 Gy

63. What is the median survival for primary CNS lymphoma following WBRT alone ?

- (1) 2 months
- (2) 36 months
- (3) 24 months
- (4) 12 months

64. Meta-analysis of chemotherapy in head and neck cancer (MACH-NC), what was the 5-year OS benefit of adding concurrent chemotherapy to RT ?

- (1) 6.5 %
- (2) 3.4%
- (3) 9.6%
- (4) 12.4%

65. Treatment is recommended for a 55-year-old female with pT1N1mic grade 1, ER/PR +ve HER-2-ve breast cancer following breast-conserving surgery and sentinel node biopsy whose recurrence score is 11 :

- (1) Completion axillary LND followed by hypofractionated whole breast RT and adjuvant endocrine therapy
- (2) Chemotherapy followed by hypofractionated whole breast and low axillary RT and adjuvant endocrine therapy.
- (3) APBI followed by adjuvant endocrine therapy
- (4) Hypofractionated whole breast RT followed by adjuvant endocrine therapy

66. What is the approximate pCR rate after pre-operative RT in patients with soft tissue sarcoma ?

- (1) 1%
- (2) 10%
- (3) 20%
- (4) 30%

67. Which molecular subgroup of medulloblastoma has the BEST prognosis ?

- (1) WNT (wingless)
- (2) SHH (sonic hedgehog)
- (3) Group 3
- (4) Group 4

68. What is the main rationale for using deep inspiration breath hold (DIBH) in breast treatments ?

- (1) Decreased dose inhomogeneity
- (2) Decreased breast separation
- (3) Increased heart sparing
- (4) Increased oesophagus sparing

69. What is the definitive radiation dose for stage-I lymphoma involving mucosa-associated lymphoid tissue (MALT) of the left parotid gland ?

- (1) 24 Gy
- (2) 36 Gy
- (3) 45 Gy
- (4) 50.4 Gy

70. What is the most common histology in paediatric brain tumor ?

- (1) Medulloblastoma
- (2) Ependymoma
- (3) Meningioma
- (4) Pilocytic astrocytoma

71. Which pathologic feature of endometrial cancer would prompt inclusion of the presacral lymphatics in the CTV for adjuvant RT ?

- (1) Cervical stromal involvement
- (2) Deep myometrial invasion
- (3) Uterine fundal involvement
- (4) Extensive LVI

72. All of the following isotopes are used for permanent prostate seed implants except:

- (1) Iodine 125
- (2) Palladium 103
- (3) Au-198
- (4) Iridium-192

73. Increased tumor cell kill of relatively radiation resistant hypoxic cells can be achieved by the concurrent administration of radiation and any of the following drugs except :

- (1) Tirapazamin
- (2) Mitomycin
- (3) Misonidazole
- (4) Fluorouracil

74. Which molecular features of low grade gliomas are associated with improved OS ?
- (1) Wild type IDH and mutant PIK3CA
 - (2) Mutant IDH and 1p/19q codeletion
 - (3) Wild type IDH and wild type PIK3CA
 - (4) Mutant IDH and no 1p/19q codeletion
75. What is abscopal effect ?
- (1) Localized response following SBRT
 - (2) Synergistic effect at the irradiated site
 - (3) Systemic effects of immunosuppression
 - (4) Therapeutic effect at distance from irradiated site
76. What is the rate of complete response in muscle-invasive bladder cancer treated with TUR-BT and Chemo-RT ?
- (1) 40-50%
 - (2) 71-80%
 - (3) 61-70%
 - (4) 51-60%
77. Which treatment with the best reported OS for a newly diagnosed glioblastoma ?
- (1) RT alone
 - (2) RT with concurrent temozolomide and adjuvant temozolomide
 - (3) RT with concurrent temozolomide and adjuvant temozolomide + bevacizumab
 - (4) RT with concurrent temozolomide and adjuvant temozolomide + tumor-treating fields
78. What is the approximate local control after radiation for pituitary adenomas ?
- (1) >90%
 - (2) 70%
 - (3) 55%
 - (4) 36%
79. Patient presents with right neck adenopathy. Biopsy shows carcinoma positive for EBV. Imaging, examination and EUA indicate no primary site of disease. Which staging system is used ?
- (1) Oropharynx
 - (2) Nasopharynx
 - (3) Unknown primary
 - (4) Head and neck skin

80. When using a larynx preservation approach for locally advanced SCC of the supraglottis, which treatment paradigm has the best local control ?

- (1) Concurrent chemo-radiation
- (2) Hyper fractionated radiation
- (3) Induction chemotherapy then radiation
- (4) Induction chemotherapy then chemo-radiation

81. Which of the following options describe the best management strategy for SCLC by AJCC stage grouping ?

- (1) Stage I SCLC-Lobectomy and adjuvant chemotherapy followed by consideration of PCI
- (2) Stage II SCLC-Chemo-radiation and consolidation with durvalumab with no PCI
- (3) Stage III SCLC-Chemo-radiation therapy followed by lobectomy and PCI.
- (4) Stage IV SCLC-Chemotherapy followed by consolidation thoracic RT to 45 Gy in 15 fractions and PCI.

82. What is the purpose of the dummy wire in 192Ir HDR remote after loader unit?

- (1) To confirm that the correct patient is being treated
- (2) To confirm that the path the radioactive source travels is clear of obstruction
- (3) To measure the activity of the radioactive source along the path of travel
- (4) To measure the dwell time accuracy of the radioactive source

83. According to the ASTRO guideline update on palliative RT for bone metastases, what fractionation schemes were shown to have pain relief equivalency in the treatment of previously unirradiated painful peripheral bone metastases ?

- (1) 8 Gy in 1 fraction, 20 Gy in 4 fractions, and 24 Gy in 6 fractions
- (2) 8 Gy in 1 fraction, 20 Gy in 4 fractions, and 30 Gy in 10 fractions
- (3) 8 Gy in 1 fraction, 20 Gy in 5 fractions, and 30 Gy in 10 fractions
- (4) 8 Gy in 1 fraction, 20 Gy in 5 fractions, and 37.5 Gy in 15 fractions

84. According to the ASTRO guideline update, what is a preferred dose fractionation schema for whole breast irradiation ?
- (1) 40 Gy in 15 fx
 - (2) 42.5 Gy in 20 fx
 - (3) 50 Gy in 25 fx
 - (4) 50.4 Gy in 28 fx
85. A 58-year-old patient with NSCLC presents with two asymptomatic, subcentimeter intracranial lesions consistent with brain metastases. Which radio therapeutic strategy is most appropriate ?
- (1) WBRT with opposed laterals
 - (2) WBRT with hippocampal Avoidance
 - (3) Stereotactic radiation
 - (4) Neurosurgical resection with cavity radiation
86. A 62-year-old man is following surgical resection of a 2.6 cm poorly differentiated squamous cell carcinoma of the left oral tongue with modified radical neck dissection, yielding 6 nodes, 2 of which were involved by tumor. All surgical margins were negative, but there was a spread of tumor beyond the capsule in one of the lymph nodes. Which of the following is the most appropriate recommendation ?
- (1) Radiation to the site of the primary tumor and the neck
 - (2) Radiation to the site of the primary tumor and the neck, with concurrent cisplatin chemotherapy
 - (3) Cisplatin-based combination chemotherapy for 6 cycles
 - (4) Observation
87. Cisplatin has all the following properties except :
- (1) It is used as a radiosensitizer with concurrent radiation therapy
 - (2) It is cell-cycle non-specific
 - (3) It is similar in efficacy to its isomer, trans-platinum
 - (4) It causes both inter-strand and intra-strand crosslinking
88. Sorafenib is FDA approved for use in treatment cancers except -
- (1) Hepatocellular carcinoma
 - (2) Thyroid cancer
 - (3) Pancreatic cancer
 - (4) Kidney cancer
89. Which of the following is a reasonable possible explanation for the longer survival times for patients treated with TPF in TAX 324 compared with the survival times for patients treated with TPF in TAX 323 ?
- (1) TAX 323 was restricted to patients with unresectable disease, whereas TAX 324 included both patients with resectable disease and patients with unresectable disease
 - (2) After induction TPF, patients in TAX 324 received radiation therapy with concurrent weekly carboplatin, whereas patients in TAX 323 received radiation therapy only after TPF
 - (3) In TAX 324, the cisplatin dose was higher than the cisplatin dose used in TAX 323.
 - (4) All of the above are true.

90. What is the most common side-effect of erlotinib ?
- (1) Fatigue
 - (2) Rash
 - (3) Anorexia
 - (4) Stomatitis
91. Resistance of tumors to multiple chemotherapeutic agents is often due to the MDR (Multiple Drug Resistance) gene. This gene encodes a protein that acts by which of the following mechanisms ?
- (1) As a Trans membrane efflux pump for chemotherapeutic agents
 - (2) As a DNA repair molecule
 - (3) As an isoform of superoxide dismutase
 - (4) As a membrane stabilizer
92. Which of the following systemic therapy agents can be used in the treatment of advanced or unresectable desmoid tumors ?
- (1) Dasatinib
 - (2) Pazopanib
 - (3) Tamoxifen
 - (4) Acetaminophen

93. Which is not a common side-effect of crizotinib ?
- (1) Vision disturbance
 - (2) Diarrhoea
 - (3) Oedema
 - (4) Thrombocytopenia
94. Which of the following are good prognostic factors in breast cancer ?
- (1) Oestrogen receptor positivity
 - (2) Grade III tumour
 - (3) HER 2 receptor overexpression
 - (4) Lymph node involvement
95. BCG for superficial bladder cancer can be potentiated for additional benefit if combined with which of the following :
- (1) Mitomycin C
 - (2) Interferon
 - (3) Epirubicin
 - (4) None of the above
96. What is the appropriate surveillance plane for a patient with stage I seminoma undergoing observation after an orchiectomy ?
- (1) Abdominal and Pelvic CT at 6 and 12 months
 - (2) Chest, Abdominal and Pelvic CT at 6 and 12 months
 - (3) Abdominal and Pelvic CT at 3, 6 and 12 months
 - (4) Chest, Abdominal and Pelvic CT at 3, 6 and 12 months

97. Which is a tumor characteristic associated with BRCA 1+ breast cancer ?

- (1) Lobular histology
- (2) Triple negative receptor staining (ER-, PR-, HER-2/Neu-)
- (3) Tubular component
- (4) HER-2/Neu amplification

98. Which solid tumor histology has the highest rate of leptomeningeal spread ?

- (1) Renal cell carcinoma
- (2) Non-small cell lung cancer
- (3) Ovarian cancer
- (4) Melanoma

99. A patient undergoes an orchiectomy for a stage I pure seminoma and then elects to undergo treatment with chemotherapy. What is the recommended chemotherapy ?

- (1) Single agent cisplatin
- (2) Bleomycin, etoposide and cisplatin
- (3) Rituximab, cyclophosphamide, doxorubicin and vincristine
- (4) Single agent carboplatin

100. In NSABP B-27, a trial of neoadjuvant chemotherapy, the addition of docetaxel to doxorubicin/cyclophosphamide improved the rate of pathologic CR from 13.7% to which percent ?

- (1) 14%
- (2) 26%
- (3) 40%
- (4) 60%

101. What is the absolute four year OS benefit of docetaxel when added to long-course ADT + RT for patients with high-risk localized prostate cancer ?

- (1) None
- (2) 5%
- (3) 10%
- (4) 15%

102. 50-year-old man with T2N2M0 EBV + Nasopharynx carcinoma is treated with 70 Gy radiation with concurrent cisplatin and has complete resolution of disease. What is the MOST appropriate next step in management ?

- (1) No further treatment; PET-CT in 12 weeks
- (2) Consolidative biotherapy/ immunotherapy
- (3) No further treatment; CT of the neck in 6 weeks
- (4) Consolidative cisplatin-based systemic chemotherapy

103. What is the AJCC 8th edition staging for pT1-4aN1 cM0 bladder cancer ?

- (1) IIIA
- (2) IIIB
- (3) IVA
- (4) IVB

104. What is the MOST common site of metastases from osteosarcoma ?

- (1) Liver
- (2) Lung
- (3) Lymph nodes
- (4) Muscle

105. What is recommended after tumor-reductive surgery for stage IIIA1 endometrioid ovarian carcinoma, metastatic to a single paraaortic lymph node ?

- (1) Observation
- (2) Chemotherapy
- (3) Pelvic RT and concurrent chemotherapy
- (4) Extended field RT and concurrent chemotherapy

106. Sino-nasal undifferentiated carcinoma (SNUC) arises from which tissue ?

- (1) Salivary glands
- (2) Notocord remnant
- (3) Olfactory epithelium
- (4) Schneiderian mucosa

107. In the RTOG 91-11 randomized trial for locally advanced larynx cancer, what was the 10 year rate of larynx preservation with concurrent chemo RT ?

- (1) 92%
- (2) 82%
- (3) 72%
- (4) 62%

108. Which salivary tumor of the parotid gland is MOST likely to present with nodal metastases ?

- (1) Pleomorphic adenoma
- (2) Salivary ductal carcinoma
- (3) Adenoid cystic carcinoma
- (4) Low-grade mucoepidermoid carcinoma

109. Why are cancer stem cells important targets of anti-cancer treatment ?

- (1) Support the development of secondary cancers
- (2) Responsible for chemo radiation toxicities
- (3) Able to repair normal tissue damage
- (4) Resistance to radiation therapy

110. Which is a radio-immunotherapy agent used to treat NHL ?

- (1) Brentuximab Vedotin
- (2) Bendamustine
- (3) Ibritumomab
- (4) Nivolumab

111. Regarding the use of durvalumab after chemo-RT in the management of stage III NSCLC :

- (1) PD-L1 staining $\geq 50\%$ is needed.
- (2) Improved OS and increased grade 3 pneumonitis is seen.
- (3) Improved OS and PFS without increase in grade 3 pneumonitis is seen.
- (4) Shorter time to death or distant metastases is seen.

112. What is the recommended treatment for a 45-year-old patient with refractory Hodgkin lymphoma involving the mediastinum, who has a complete response by PET/CT scan to 2nd line chemotherapy ?

- (1) Surgery alone
- (2) Radiation alone
- (3) High dose chemotherapy + allogeneic SCT
- (4) High dose chemotherapy + autologous SCT

113. The likelihood of nodular lymphocyte predominant Hodgkin lymphoma (NLPHL) transforming to higher grade DLBCL is in the range of :

- (1) 0-5%
- (2) 10-15%
- (3) 20-25%
- (4) 30-35%

114. What is the risk of progression of solitary bone plasmacytoma to multiple myeloma in 10 years ?

- (1) 10-25%
- (2) 30-50%
- (3) 65-85%
- (4) >90%

115. Which is a KEY difference between breast cancers in women versus men ?

- (1) Use of mammography as initial imaging test
- (2) Use of sentinel node biopsy for axillary staging
- (3) Use of the TMN staging system
- (4) Use of single agent aromatase inhibitors in the adjuvant setting

116. What is the most appropriate chemotherapy for a patient who presents with distant metastases from newly diagnosed oropharyngeal SCC ?

- (1) Nivolumab
- (2) Pembrolizumab
- (3) Paclitaxel/Cisplatin/5FU (TPF)
- (4) Cisplatin/5FU/Cetuximab (CCF)

117. For patients with newly diagnosed primary CNS lymphoma, the recommended chemotherapy includes :

- (1) CHOP
- (2) Methotrexate
- (3) BEACOPP
- (4) ABVD

118. What is the most effective adjuvant chemotherapy regimen for resectable pancreatic cancer ?

- (1) FOLFOX
- (2) Gemcitabine/capecitabine
- (3) Gemcitabine/abraxane
- (4) FOLFIRINOX

119. What is the principle mechanism of action of gemcitabine ?

- (1) Induction of DNA dsbs
- (2) Induction of interstrand crosslinks
- (3) Inhibition of DNA synthesis and repair
- (4) Inhibition of mRNA polyadenylation

120. What is a contraindication to the use of bevacizumab in patients with metastatic non-small cell lung cancer ?

- (1) Previous history of haemoptysis
- (2) Brain metastasis
- (3) On Anticoagulation pharmacotherapy
- (4) All of the above

121. The lowest risk for Cardiac toxicity is to be expected with which Anthracycline and its cumulative dose ?

- (1) Doxorubicin > 500 m²
- (2) Epirubicin >720 m²
- (3) Idaurubicin >90m²
- (4) Liposomal doxorubicin >600m²

122. 75 years old man receives monotherapy with oral capecitabine for colon cancer metastatic to liver. Twelve days after treatment initiation he develops grade 4 febrile neutropenia and grade 3 diarrhoea and mucositis. Which of the following drug- metabolizing enzymes is most likely to be deficient in this patients ?

- (1) CYP2D6
- (2) Dihydropyrimidine dehydrogenase (DPD)
- (3) O6-methylguanine methyltransferase (MGMT)
- (4) Thiopurine 5-methyltransferase (TPMT)

123. Which is the standard of care in first line treatment of metastatic HER2 positive breast cancer for women in good clinical condition ?

- (1) Trastuzumab + epirubicin + paclitaxel
- (2) Trastuzumab + pertuzumab + docetaxel
- (3) Trastuzumab + lapatinib + capecitabine
- (4) Trastuzumab – emtansine (T-DM1)

124. A 65-years-old man undergoes surgical excision of right temporal anaplastic oligodendroglioma. Post-operatively, in addition to radiation, which biomarker suggests increased benefit from chemotherapy ?

- (1) 1p/19q chromosomal codeletion
- (2) Methylation of MGMT promoter
- (3) Mutation of IDH1 and IDH2
- (4) PTEN loss

125. Five-year survival rates of patients with low-risk, non-metastatic gestational trophoblastic disease approaches

- (1) 100%
- (2) 75%
- (3) 50%
- (4) 25%

126. The most likely karyotype for patient with a partial mole would be
- (1) 46, XX
 - (2) 46, XY
 - (3) Triploidy
 - (4) Aneuploidy
127. Which lymph nodes are considered a distant disease for breast cancer staging ?
- (1) Cervical nodes
 - (2) Supraclavicular nodes
 - (3) Intramammary nodes
 - (4) Rotter's nodes
128. Which of the following processes characterizes the level of disease prevention known as tertiary prevention ?
- (1) Prevention of disease before its biological onset
 - (2) Prevention of disease progression and additional disease complications after overt clinical disease occurs
 - (3) Prevention of clinical illness through the early and asymptomatic detection and remediation of certain disease conditions.
 - (4) Prevention of illness through appropriate individual and group behavior modification designed to minimize infection risk

129. Which one of the following formulae is commonly used to calculate the BSA for adult patients receiving chemotherapy ?
- (1) Calvert
 - (2) Cockcroft
 - (3) Dubois
 - (4) Jelliffe
130. Stewart-Treves syndrome is known to occur in patients with which of the following ?
- (1) Varicose Veins
 - (2) Post Mastectomy lymphedema
 - (3) Colon Cancer
 - (4) Pancreatic Cancer
131. A 75-years old patient comes in with jaundice and abdominal pain. The abdominal ultrasound finds a GB region mass. A magnetic resonance cholangiopancreatography (MRCP) is ordered. The clinician diagnoses it as likely a Klatskin tumor. Where are Klatskin tumors usually located ?
- (1) The distal common bile duct
 - (2) The junction of the left and right hepatic ducts
 - (3) The cystic duct origin
 - (4) An intrahepatic location

132. A homosexual male is seen for a routine check-up. He denies any constitutional symptoms. He expresses concern that he has some fleshy nodules around the anus and wants to get rid to them. What is the most likely cause of his anal nodules ?

- (1) HPV 12
- (2) HPV 32
- (3) HPV 6 and 11
- (4) Herpes simplex 2

133. Which of the following statements regarding mucinous breast carcinomas is true ?

- (1) They account for 18% of all breast cancers
- (2) Lymph node involvement is seen in 80% of the cases
- (3) They are characterized by a rapid growth pattern.
- (4) They carry a more favorable prognosis than invasive ductal carcinoma.

134. After neoadjuvant therapy, the primary tumor has completely disappeared on the resection specimen, the correct classification is

- (1) ypTx
- (2) ycT0
- (3) ypT0
- (4) none of the above

135. The correct statement below is :

- (1) HPV vaccination is highly effective against development of cervical dysplasia
- (2) HPV vaccination is highly effective against development of anal and cervical dysplasia
- (3) HPV vaccination is highly effective against development of cervical, anal and oral dysplasia
- (4) All the above

136. Cancer histology is derived from the embryological remnant of the urachus

- (1) Transitional Cell
- (2) Adenocarcinoma
- (3) Squamous cell carcinoma
- (4) Pheochromocytoma

137. The most validated pain intensity scale is known as the

- (1) Visual analogue scale
- (2) Faces scale
- (3) Visual rating scale
- (4) Visual number scale

138. Opioid treatment fits best on which step of the WHO analgesic ladder?

- (1) Step One
- (2) Step Two
- (3) Step Three
- (4) Step Four

139. What is opiophobia ?

- (1) Fear of opioid plant
- (2) Fear of drugs
- (3) Fear of prescribing opioid drugs
- (4) Fear of anaesthesia

140. A 60-year-old woman with locally advanced cancer of the left breast presented with recent-onset lymphedema of her left arm. She is not a candidate for radical resection, and due to her pulmonary co morbidities, she is unable to tolerate radiotherapy. Her examination shows a very swollen left arm, elbow and wrist associated with ischaemic changes in the fingers of her left hand. There is no radial pulse and Doppler ultrasound scan shows no thrombus in any of the veins however reduced flow within her brachial arteries. What is the most appropriate initial management of her lymphedema ?

- (1) Compression sleeve
- (2) Manual lymphatic drainage
- (3) Frusemide and spironolactone
- (4) Surgical debulking

141. A 70-year-old male with metastatic prostate cancer with multiple bony lesions complains of sudden onset right hip pain. A CT scan shows a large lytic lesion with cortical thinning within the upper third of the femur. What is the most appropriate management for this patient ?

- (1) Denosumab/ Bisphosphonates
- (2) Radiotherapy
- (3) Surgical Fixation
- (4) Non-weight bearing status

142. Signs of opioid toxicity include :

- (1) Hypertension, aggression
- (2) Irritability and restlessness
- (3) Drowsy
- (4) Sleepiness, respiratory depression, pinpoint pupils

143. The highest success rate with nerve blocks is seen with:

- (1) Coeliac plexus block
- (2) Intrathecal block
- (3) Cryotherapy
- (4) Brachial block

144. Which of the following most accurately describes “breakthrough” pain ?

- (1) Associated with pathological fractures
- (2) Refers to a new psychological or spiritual insight
- (3) Can occur as end-of-dose failure
- (4) An aspect of opioid pseudo-addiction

145. Which of the following is an example of nociceptive pain ?

- (1) Chemotherapy induced paraesthesia
- (2) Post herpetic neuralgia
- (3) Colic from subacute intestinal obstruction
- (4) Right arm pain from brachial plexopathy

146. Principles of palliative care are :

- (1) Psycho-social care, symptom control & disease management
- (2) Providing adequate analgesic, disease management and place to die
- (3) Disease management, intensive care and symptom control
- (4) Religious/ spiritual support and psychosocial care

147. Which of the following pairs of cancer type and corresponding genetic alterations in that cancer is FALSE ?

- (1) Pancreatic-K-RAS
- (2) Lung adenocarcinoma-ALK
- (3) Colon-PTCH
- (4) Thyroid-RET

148. A 64 years old male has been recently diagnosed with non-small cell lung cancer, stage IIIB. He has an ECOG performance status of 0. He presents acutely to the emergency department with upper limb swelling conjunctival suffusion, stridor and significant dyspnoea. What is the most appropriate diagnosis matched with treatment strategy ?

- (1) Superior vena cava syndrome, surgical stent insertion
- (2) Superior vena cava syndrome, chemotherapy
- (3) Superior vena cava syndrome, chemotherapy and radiotherapy
- (4) Pulmonary embolism, therapeutic unfractionated heparin

149. What is the most common cause of superior vena cava obstruction syndrome ?

- (1) Small cell lung cancer
- (2) Lymphoma
- (3) Non-small cell lung cancer
- (4) Metastatic deposits

150. What is the RT dose and fractionation for prophylaxis against heterotopic ossification ?

- (1) 30 Gy * 10 Fraction
- (2) 10 Gy * 5 Fraction
- (3) 5 Gy * 1 Fraction
- (4) 7 Gy * 2 Fraction

151. A 68 year old male has been recently diagnosed with prostate malignancy. He presents acutely to the radiotherapy department with severe pain in right side peritrochanteric region. His x-ray pelvis shows lytic destruction peritrochanteric region and the **Mirels scoring system** is twelve. What is the most appropriate treatment strategy ?

- (1) Radiotherapy
- (2) Radiotherapy + Internal fixation
- (3) Internal fixation prior to RT
- (4) Internal Fixation

152. What is the optimal total radiation dose required for immunosuppression and tumoral cell eradication in fractionated TBI regimens ?

- (1) 2-4 Gy
- (2) 4-6 Gy
- (3) 6-8 Gy
- (4) 8-12 Gy

153. What is an advantage of a cross-over study ?

- (1) Carry-over effect
- (2) Increased drop-out
- (3) Efficiency increase
- (4) Slow recruitment

154. What is the correct interpretation of hazard ratio (HR) ?

- (1) $HR = \text{hazard in the control group} / \text{hazard in the intervention group}$
- (2) HR of 0.5 means that twice as many patients in the treatment group are experiencing an event compared to the control group
- (3) HR of 1.0 means that at any particular time the event rates are the same for both groups
- (4) HR of 2.0 means that at any particular time, half as many patients in the treatment group are experiencing an event compared to the control group

155. What is the primary goal of a Phase IV trial ?

- (1) Determine MTD
- (2) Obtain FDA approval
- (3) Post approval assessment of safety and effectiveness
- (4) Investigate off-label indications

156. What is the MOST common radiation dose for treatment of Graves' ophthalmopathy ?

- (1) 8 Gy in 1 fx
- (2) 20 Gy in 5 fx
- (3) 20 Gy in 10 fx
- (4) 30 Gy in 15 fx

157. What is FDA approved treatment to minimize acute radiation syndrome in the event of a radiation emergency ?

- (1) Amifostine
- (2) Sargramostim
- (3) Cisplatin
- (4) Gefitinib

158. The overall RBE factor of a proton therapy beam is :

- (1) 1.0
- (2) 1.1
- (3) 1.3
- (4) 1.8

159. How does hyperthermia enhance radiation-induced tumor growth delay ?

- (1) Decreases tumor oxygenation
- (2) Decreases formation of DNA lesions
- (3) Inhibits repair of DNA damage
- (4) Inhibits the blood supply to the tumor

160. For which one of the following would a BIRADS 6 classification be most appropriate ?

- (1) Post procedure mammogram for marker placement
- (2) Prior treated breast cancer
- (3) Recent biopsy proven breast cancer
- (4) Suspicious abnormality; needs biopsy

161. Spinal cord compression is optimally treated by :

- (1) SBRT
- (2) RT alone
- (3) Surgical decompression/ stabilization + RT
- (4) Surgical decompression/ stabilization alone

162. Protons are preferred for therapeutic treatments of some anatomical sites. What is the principal justification for this ?

- (1) DNA damage is irreparable
- (2) Hypoxic cells are sensitive to photons
- (3) Limit dose to normal tissue
- (4) The OER for protons is above 4

163. Cells in which phase of the cell cycle are MOST resistant to hyperthermia-induced cell killing ?

- (1) G1
- (2) S
- (3) G2
- (4) M

164. What is the MOST dose limiting side effect of TBI ?

- (1) Cardiac failure
- (2) Pancreatitis
- (3) Pneumonitis
- (4) Enteritis

165. What change is incorporated in the 2018 AJCC staging guidelines for soft tissue sarcoma ?

- (1) Histologic grade is no longer included
- (2) N1 is Stage group III
- (3) Retroperitoneal location is staged separately
- (4) T3 includes tumors from 10-20 cm

166. Based on the National Lung Cancer Screening Trial (NLST), which of the following parameters from smoking history is NOT a risk factor to select patients for lung cancer screening ?

- (1) ≥ 30 pack-year smoking history
- (2) Smoking cessation < 15 years
- (3) Age 55-74 years
- (4) Second-hand smoking history

167. The lifetime of an OH radical is approximately :

- (1) 10^{15} second
- (2) 10^{-9} second
- (3) 10^{-1} second
- (4) 1 second

168. Which phase trial is used to determine maximum tolerated dose (MTD) ?

- (1) Phase I
- (2) Phase II
- (3) Phase III
- (4) Phase IV

169. What is the typical maximum energy of protons accelerated in a modern cyclotron used for therapeutic proton radiotherapy ?

- (1) 75 MeV
- (2) 125 MeV
- (3) 250 MeV
- (4) 500 MeV

170. Which is correct for double-blind Phase III clinical trial ?

- (1) Both investigators and participants do not know the treatment.
- (2) The investigators know the treatment, but the participants do not.
- (3) The participants know the treatment, but the investigators do not.
- (4) Both investigators and participants know the treatment.

171. Regarding pair production and annihilation, which of the following is true ?

- (1) The incident photon is scattered with reduced energy
- (2) Annihilation photons always have an energy of 0.511 MeV each
- (3) A pair of orbital electrons are ejected from the atom
- (4) It cannot occur if the photon energy is above 1.02 MeV

172. Following total thyroidectomy for papillary thyroid carcinoma, which of the following is an indication for radioactive iodine (RAI) therapy ?

- (1) Multifocal disease
- (2) High risk histologic subtypes
- (3) Microscopically positive margins (RI)
- (4) Postoperative unstimulated thyroglobulin levels $> 5-10$

173. Which of the following matches is not correct for ICRU reports ?
- (1) ICRU 38-brachytherapy
 - (2) ICRU 78-proton therapy
 - (3) ICRU 71-electron therapy
 - (4) ICRU 72-external therapy
174. In adults, where does the spinal cord typically end ?
- (1) L1
 - (2) L3
 - (3) L5
 - (4) S1
175. Which action improves the dose homogeneity when treating with same energy, parallel-opposed photon treatment fields ?
- (1) Using uneven beam weighting
 - (2) Increasing the treatment volume separation
 - (3) Decreasing the treatment field size
 - (4) Increasing the photon beam energy
176. There is no transfer of energy to atoms so ionization does not occur. This type of photon-matter interaction is called:
- (1) Coherent scattering
 - (2) Photoelectric effect
 - (3) Compton effect
 - (4) Photodisintegration

177. Which phase of the cell cycle is most sensitive to hyperthermia induced cell killing ?
- (1) G1
 - (2) S
 - (3) G2
 - (4) G0
178. For an open, flattening filter free beam, at what location within the photon beam, dose rate is the highest ?
- (1) Central beam axis
 - (2) Off axis
 - (3) Penumbra region
 - (4) Bragg peak
179. What is a factor that should be considered in a CTV to PTV expansion ?
- (1) Microscopic invasion into surrounding tissue
 - (2) Dose fractionation
 - (3) Serial or parallel nature of the CTV
 - (4) Patient immobilization
180. For a low energy, poly-energetic X-ray beam, the second half-value layer (HVL) as compared to the first HVL is :
- (1) smaller
 - (2) the same
 - (3) larger
 - (4) larger only for small field sized

रफ कार्य के लिए स्थान / SPACE FOR ROUGH WORK

