

## API

### PROVISIONAL ANSWER KEY [CBRT]

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### Instructions / સૂચના

**Candidate must ensure compliance to the instructions mentioned below, else objections shall not be considered: -**

- (1) All the suggestion should be submitted in prescribed format of suggestion sheet Physically.
- (2) Question wise suggestion to be submitted in the prescribed format (Suggestion Sheet) published on the website.
- (3) All suggestions are to be submitted with reference to the Master Question Paper with provisional answer key (Master Question Paper), published herewith on the website. Objections should be sent referring to the Question, Question No. & options of the Master Question Paper.
- (4) Suggestions regarding question nos. and options other than provisional answer key (Master Question Paper) shall not be considered.
- (5) Objections and answers suggested by the candidate should be in compliance with the responses given by him in his answer sheet. Objections shall not be considered, in case, if responses given in the answer sheet /response sheet and submitted suggestions are differed.
- (6) Objection for each question shall be made on separate sheet. Objection for more than one question in single sheet shall not be considered & treated as cancelled.

**ઉમેદવારે નીચેની સૂચનાઓનું પાલન કરવાની તકેદારી રાખવી, અન્યથા વાંધા-સૂચન અંગે કરેલ રજૂઆતો ધ્યાને લેવાશે નહીં**

- (1) ઉમેદવારે વાંધા-સૂચનો નિયત કરવામાં આવેલ વાંધા-સૂચન પત્રકથી રજૂ કરવાના રહેશે.
- (2) ઉમેદવારે પ્રશ્નપ્રમાણે વાંધા-સૂચનો રજૂ કરવા વેબસાઈટ પર પ્રસિધ્ધ થયેલ નિયત વાંધા-સૂચન પત્રકના નમૂનાનો જ ઉપયોગ કરવો.
- (3) ઉમેદવારે પોતાને પરીક્ષામાં મળેલ પ્રશ્નપુસ્તિકામાં છપાયેલ પ્રશ્નક્રમાંક મુજબ વાંધા-સૂચનો રજૂ ન કરતા તમામ વાંધા-સૂચનો વેબસાઈટ પર પ્રસિધ્ધ થયેલ પ્રોવિઝનલ આન્સર કી (માસ્ટર પ્રશ્નપત્ર)ના પ્રશ્ન ક્રમાંક મુજબ અને તે સંદર્ભમાં રજૂ કરવા.
- (4) માસ્ટર પ્રશ્નપત્ર માં નિર્દિષ્ટ પ્રશ્ન અને વિકલ્પ સિવાયના વાંધા-સૂચન ધ્યાને લેવામાં આવશે નહીં.
- (5) ઉમેદવારે જે પ્રશ્નના વિકલ્પ પર વાંધો રજૂ કરેલ છે અને વિકલ્પ રૂપે જે જવાબ સૂચવેલ છે એ જવાબ ઉમેદવારે પોતાની ઉત્તરવહીમાં આપેલ હોવો જોઈએ. ઉમેદવારે સૂચવેલ જવાબ અને ઉત્તરવહીની જવાબ ભિન્ન હશે તો ઉમેદવારે રજૂ કરેલ વાંધા-સૂચન ધ્યાનમાં લેવાશે નહીં.
- (6) એક પ્રશ્ન માટે એક જ વાંધા-સૂચન પત્રક વાપરવું. એક જ વાંધા-સૂચન પત્રકમાં એકથી વધારે પ્રશ્નોની રજૂઆત કરેલ હશે તો તે અંગેના વાંધા-સૂચનો ધ્યાને લેવાશે નહીં.



013. The feasibility of sterilizing the testes without damaging the scrotal skin by fractionating the radiation dose was demonstrated in animal experiments by -  
 (A) Claude Regaud (B) Reisner  
 (C) Strandqvist (D) Henri Coutard
014. The optimal primary therapy for true solitary plasmacytoma of bone is?  
 (A) Chemotherapy (B) Bone marrow transplant  
 (C) Immunotherapy (D) Radiotherapy to a dose of 40 - 50 Gy
015. As per RTOG study 78-10, the maximum tolerated dose (MTD) for single dose upper hemi body radiation (after correcting the lung dose) is -  
 (A) 6Gy (B) 7Gy  
 (C) 8Gy (D) 4Gy
016. Which of the following statements is INCORRECT regarding Thermo Dox ?  
 (A) Uses a lysolipid thermally sensitive liposome in cancer treatment  
 (B) Consists of Doxorubicin encapsulated by a heat sensitive liposome  
 (C) The liposome undergoes structural transformation when heated to temperature of 60° to 70°C  
 (D) Leads to release of doxorubicin directly into or near the targeted tumor
017. Which of the following scientists is credited with the discovery of electrons?  
 (A) Niels Bohr (B) Sir James Chadwick  
 (C) Sir. J.J. Thomson (D) Ernest Rutherford.
018. Which of the following statements concerning the interaction of photons with matter is CORRECT?  
 (A) The probability of the photoelectric effect decreases with the atomic number of the absorber.  
 (B) In the Compton process, the energy of the scattered photon is less than that of the incident photon.  
 (C) The predominant interaction of 10 keV photons with soft tissue is the Compton process.  
 (D) Pair production occurs for photons with energies less than 1.02 MeV.
019. Which of the following statements related to DO dose is INCORRECT?  
 (A) It is the dose of radiation that induces an average of one lethal event per cell.  
 (B) It causes around 40 double strand DNA breaks per cell.  
 (C) It causes > 1000 single strand DNA breaks per cell.  
 (D) For mammalian cells, the x-ray DO usually lies between 3-4 Gy.
020. Telomerase activity is NOT detectable in which of the following tissues?  
 (A) Cancer cell lines. (B) Normal human somatic tissues.  
 (C) Embryonic stem cells. (D) Gametes.
021. Which of the following radiation induced chromosomal change is NOT lethal to the cell?  
 (A) Symmetric Translocations (B) Dicentric formation  
 (C) Ring formation (D) Anaphase bridge formation.
022. At which optimal value of LET (Linear energy transfer) does radiation have the greatest Relative biological efficiency (RBE) to produce cell kill or mutagenesis?  
 (A) 100 keV/μm (B) 10 keV/μm  
 (C) 0.01 keV/μm (D) 1000 keV/μm
023. Which phase of the cell cycle is considered to be the most resistant to radiation effects?  
 (A) Early S phase (B) Late S phase  
 (C) Late G1 phase (D) Late G2 phase

024. Which of the following cell lines has an unlimited life span, is considered immortal and used in oncogenic transformation studies?
- (A) Hamster embryo cells (B) Human skin fibroblast cells  
(C) Human embryo cells (D) BALB/C-3T3 cell line
025. Which of the following molecular technologies is NOT capable of detecting variable single nucleotide substitutions?
- (A) FISH (B) Sanger sequencing  
(C) NGS (next generation sequencing) (D) HRM (high resolution melting) curve analysis
026. All of the following tumors are considered as AIDS defining illness by the CDC in the context of HIV infection EXCEPT -
- (A) Kaposi's Sarcoma (B) Squamous Cell carcinoma of anal canal  
(C) AIDS related NHL (D) Cervical Cancer
027. The lowest radiation dose in Total body radiation (TBI) which can cause depletion of lymphocytes is -
- (A) 0.1 Gy (B) 1 Gy  
(C) 0.3 Gy (D) 0.5 Gy
028. Which of the following statements is CORRECT regarding the small lymphocyte?
- (A) These cells are highly radiosensitive (B) These cells usually do not divide  
(C) These cells show interphase death (D) All of the above.
029. A 67-year-old male underwent endoscopy for weight loss which showed a growth extending from mid esophagus to OG junction. Biopsy was suggestive of grade 3 squamous cell carcinoma. PET CT confirmed local extent as seen on endoscopy without evidence of regional nodes or visceral metastasis. He also underwent EUS of the esophagus which suggested growth extending to muscularis propria. What will be his estimated clinical TNM stage?
- (A) c T1a N0 M0 (B) c T1b N0 M0  
(C) c T2 N0 M0 (D) c T3 N0 M0
030. A 35-year-old woman with a strong family history of breast cancer is referred to the cancer genetics clinic and is found to have a germ line mutation in the BRCA2 gene. Apart from breast and ovarian cancer which other type of cancer does she have a risk of developing?
- (A) Melanoma (B) Colorectal cancer  
(C) Thyroid cancer (D) Lung cancer
031. In a scatter plot which of the following statements regarding correlation coefficient "r" is INCORRECT?
- (A) Strong correlation implies causation  
(B) The value of "r" is always between -1 and +1  
(C) A positive value of r means positive correlation  
(D) A negative value of r means negative correlation
032. Which of the following statements is CORRECT regarding null hypothesis?
- (A) The population correlation coefficient or p value is not significantly different from zero.  
(B) There is no significant linear relationship (correlation) between variables x and y in the population.  
(C) Both of the above.  
(D) None of the above.

033. 26-year-old man presents to your clinic with paroxysmal hypertension and headaches. His father died from an intracranial bleed following a hypertensive crisis. The patient's blood examination shows catecholamine hypersecretion and MRI shows an adrenal mass. Which of the following conditions would you exclude with this history?
- (A) Von Hippel-Lindau disease
  - (B) Multiple endocrine neoplasia type 1
  - (C) Multiple endocrine neoplasia type 2
  - (D) Hereditary paraganglioma-pheochromocytoma syndrome
034. What is the mode of inheritance of mutations of the Rb gene?
- (A) Autosomal dominant
  - (B) Autosomal recessive
  - (C) X-linked
  - (D) X-linked recessive
035. If there is doubt about the correct T stage categorization in a patient, what is the recommended approach?
- (A) Mention both categories that are in consideration, e.g. T1-2
  - (B) Mention as unknown e.g. Tx
  - (C) Always choose the higher category
  - (D) Always choose the lower category
036. A lady underwent wire guided excision biopsy for a non-palpable BIRADS V left sided breast lesion along with sentinel lymph node biopsy. The pathological size of the tumor was 1.2 cm and it was reported as DCIS with no evidence of invasive component and sentinel node was negative for metastasis. What is her appropriate pT stage?
- (A) pT1c
  - (B) pTis
  - (C) pT1b
  - (D) pT1a
037. Regarding sentinel lymph node which of the following statements is INCORRECT?
- (A) It is the first lymph node to receive lymphatic drainage from a primary tumor.
  - (B) If it contains metastatic tumor then other lymph nodes may contain tumor.
  - (C) If it does not contain metastatic tumor, then other lymph nodes are unlikely to contain tumor.
  - (D) Usually only one sentinel lymph node will receive the metastatic deposit from a primary tumor.
038. In TNM staging of breast cancer which of the following statements is CORRECT?
- (A) When there are multiple foci of microinvasion, the sum of sizes of all individual foci is used to denote the microinvasive component.
  - (B) Dimpling of skin and nipple retraction denote stage T4b.
  - (C) Stage T4a denotes tumor extension to chest wall which includes ribs, intercostal muscles, serratus anterior and pectoralis major muscles.
  - (D) None of the above.
039. According to the TNM staging of anal cancer if a patient has radiological evidence of significant inguinal and external iliac lymphadenopathy the appropriate nodal staging is -
- (A) N1b
  - (B) N1c
  - (C) N2
  - (D) N2b
040. Which of the following statements regard liquid biopsy is INCORRECT?
- (A) Used to genotype tumors
  - (B) It is a surrogate for tumor burden
  - (C) Helps to monitor the genomic drift of a tumor upon treatment.
  - (D) It cannot assess presence of minimal residual disease following curative treatment.

041. Which of the following IHC markers is used in the diagnosis of Transitional cell carcinoma of bladder?  
 (A) Calretinin (B) CD34  
 (C) GATA3 (D) DOG 1
042. Which of the following virus is implicated in the causation of Kaposi's sarcoma?  
 (A) Human herpes virus-8 (B) Cytomegalovirus  
 (C) Human Papilloma virus (D) None of the above
043. Which of the following statements pertaining to the term pseudo progression seen in follow up of malignant gliomas post chemo-radiation is INCORRECT?  
 (A) Consistent with radiological signs of progression  
 (B) Most of these changes resolve without treatment  
 (C) Biopsy of these lesions reveals tumor necrosis  
 (D) It usually occurs several years after completion of treatment.
044. A spindle cell tumor with biphasic histology and strong, diffuse positivity for TLE1 is most likely to be which of the following?  
 (A) Alveolar soft part sarcoma (B) Synovial sarcoma.  
 (C) Embryonal RMS (D) Dermato fibrosarcoma protuberans
045. Temozolomide used in GBM treatment is a prototype of which class of alkylating agents?  
 (A) Nitrosoureas (B) Nitrogen mustard  
 (C) Triazines (D) Alkyl Sulfonate
046. Which statement is INCORRECT about mantle cell lymphoma?  
 (A) Composed of small- to medium-sized B cells with the characteristic t (11; 14) translocation.  
 (B) Cells express CD 23 and CD 10 and are negative for CD 5 and CD 43  
 (C) NOTCH 1 mutation and SOX11 overexpression has a poor prognosis.  
 (D) Most cases are associated with cyclin D1 over expression
047. All the following statements regarding pharmacological properties of Amifostine are correct EXCEPT?  
 (A) It is a US FDA approved radio protector.  
 (B) When administered 30 minutes prior to RT, it reduces severity of xerostomia.  
 (C) It is dephosphorylated by the enzyme acid phosphatase to the active metabolite WR-1065.  
 (D) It is reported to offer protection against nephrotoxicity of Cisplatin.
048. Which of the following particles are products of a p particle decay?  
 (A) Auger electrons (B) Positron and Negatron  
 (C) Helium nucleus (D) Carbon ions
049. What is the relation between frequency and wavelength in electromagnetic radiation?  
 (A) Wavelength is directly proportional to frequency  
 (B) Wavelength and frequency are inversely related  
 (C) The product of frequency and wavelength is Planck's constant  
 (D) Wavelength is always equal to frequency.
050. Isotones are defined as -  
 (A) Atoms with the same number of neutrons but different atomic number  
 (B) Atoms with the same atomic number but different neutron number  
 (C) Atoms with same atomic number and neutron number but different nuclear energy states.  
 (D) Atoms with the same mass number but different atomic number.

051. Referred otalgia in oropharyngeal cancer occurs due to involvement of  
 (A) Mandibular branch of V<sup>th</sup> cranial nerve. (B) VIII<sup>th</sup> cranial nerve.  
 (C) Jacobson branch of IX<sup>th</sup> cranial nerve. (D) XI<sup>th</sup> cranial nerve.
052. In Magnetic Resonance Spectroscopy (MRS) study of brain tumors which metabolite is a marker of neuronal viability?  
 (A) Choline. (B) Creatine.  
 (C) N-acetyl aspartate. (D) Thallium.
053. Which of the following statements is a conclusion of the Meta-Analysis of Chemotherapy in Head and Neck Cancer (MACH-NC) Collaborative Group?  
 (A) Concurrent chemo-radiation benefit is more significant in oropharynx and larynx.  
 (B) Concurrent Chemo radiation improves OS by 6.5%.  
 (C) Benefit of concurrent chemo radiation is greater than induction chemotherapy.  
 (D) All of the above.
054. Pre radiotherapy dental prophylaxis in head and neck cancer radiation includes all of the following statements EXCEPT?  
 (A) Teeth with high-risk dental factors in the radiation field should only be removed before the commencement of RT.  
 (B) Ideally a healing time of 14 to 21 days is recommended after extraction before initiating RT.  
 (C) Extraction should be accomplished without significant dental trauma.  
 (D) Extraction of all healthy teeth in the radiation field reduces the risk of osteoradionecrosis and is recommended.
055. Which of the following MRI sequence gives information on cellularity of tumors?  
 (A) T1 weighted images.  
 (B) Diffusion weighted Imaging (DWI) and ADC map.  
 (C) T2 weighted sequence.  
 (D) FLAIR sequence.
056. Which of the following tumors is classified as WHO grade 1 glioma?  
 (A) Oligodendroglioma (IDH mutated, 1p/19q codeleted, tumors)  
 (B) IDH-mutated astrocytoma (non-1p/19q codeleted)  
 (C) IDH wild-type astrocytoma  
 (D) Dysembryoplastic neuro-epithelial tumor (DNET)
057. BI-RADS category 0 assignment on a mammogram indicates which of the following -  
 (A) A negative mammogram, with a recommendation for short term follow up  
 (B) A negative mammogram, with a recommendation for annual screening  
 (C) Incomplete assessment, with a recommendation for review of prior studies or completion of additional studies  
 (D) Incomplete assessment, with a recommendation for routine screening
058. Which of the following findings are not associated with Cauda equina syndrome?  
 (A) Asymmetric painful lumbosacral polyradiculopathy.  
 (B) Asymmetric cranial neuropathy.  
 (C) Patchy sensory deficit corresponding to lower lumbar and sacral nerve roots.  
 (D) Bladder and bowel incontinence.

059. Oncotype DX® score is used in which subset of early breast cancer patients?  
 (A) In node negative with Luminal A breast cancer  
 (B) In node negative with Triple negative breast cancer  
 (C) In node positive with Luminal A breast cancer  
 (D) In node positive with Luminal B breast cancer
060. Which of the following is an adverse effect seen with Denosumab usage?  
 (A) Renal failure. (B) Hyperkalemia.  
 (C) Osteonecrosis of the jaw. (D) Bone marrow suppression.
061. Which of the following drugs is a component of step II in WHO step ladder pain management protocol?  
 (A) Morphine  (B) Codeine  
 (C) Hydromorphone (D) Fentanyl
062. Which is the most common site of bone metastasis in breast cancer?  
 (A) Pelvis (B) Femur  
 (C) Ribs (D) Spine
063. Regarding Bremsstrahlung radiation all of the following statements are true EXCEPT?  
 (A) It can result in photons that may have any energy up to the initial energy of the incident electron.  
 (B) As the kinetic energy of the electrons decreases, the direction of x-ray emission becomes increasingly forward.  
 (C) The efficiency of x-ray production is proportional to the atomic number  $Z$  of the target and the voltage applied to the tube.  
 (D) The maximum energy is numerically equal to the peak voltage.
064. LET value for  $^{60}\text{Co}$   $\gamma$ -rays is -  
 (A) 0.2 keV/ $\mu\text{m}$  (B) 2 keV/ $\mu\text{m}$   
 (C) 5 keV/ $\mu\text{m}$  (D) 50 keV/ $\mu\text{m}$
065. In a Linear Accelerator, pulsed microwaves produced in the magnetron or klystron are injected into the accelerator tube by which structure?  
 (A) Thyatron (B) Electron gun  
 (C) Wave guide (D) Modulator
066. What is the radiation weighting factor  $W_R$  given by ICRP for protons?  
 (A) 1  (B) 2  
 (C) 3 (D) 20
067. Exposure to radiation in the pre implantation stage of pregnancy does NOT cause which of the following effects on the embryo?  
 (A) Implantation failure.  
 (B) Death of embryo.  
 (C) Normal growth of the embryo if it survives.  
 (D) Growth retardation.
068. What is the  $d_{90}$  value of electron energy 9 MeV?  
 (A) 1.2 cm  (B) 2.25 cm  
 (C) 3 cm (D) 4.50 cm

069. Which of the following statements on Half value layer (HVL) is INCORRECT?  
 (A) It is an indicator of beam quality.  
 (B) It denotes the thickness of the attenuating material.  
 (C) The unit of HVL is kV / m.  
 (D) In general, the HVL increases with increasing filter thickness.
070. Which of the following elements is NOT a constituent of Cerrobend?  
 (A) Lead  (B) Tungsten  
 (C) Bismuth (D) Zinc
071. Which of the following components of the linear accelerator has the greatest influence in determining the shape of the isodose curves?  
 (A) Flattening filter. (B) Multi leaf collimator.  
 (C) Collimator. (D) Bending magnet.
072. When parallel opposed fields are used in a radiation plan, what is the rationale behind treating both fields daily?  
 (A) Heel effect. (B) Penumbra effect.  
 (C) Dose rate effect. (D) Edge effect.
073. Which of the following statements is INCORRECT regarding ICRU volumes?  
 (A) GTV cannot be defined if the tumor has been surgically removed.  
 (B) CTV represents the true location and extent of tumor.  
 (C) PRV includes organ at risk (OAR) plus internal and set up margin.  
 (D) None of the above.
074. Which of the following choices is an advantage of MVCBCT over KVCBCT?  
 (A) Better contrast  
 (B) Better soft tissue visibility  
 (C) Less susceptibility to imaging artifacts due to metallic objects  
 (D) Better compatibility with the reference treatment plan images for patient setup verification and correction
075. Which of the statements about DVH is INCORRECT?  
 (A) It is a great tool for evaluating a given plan or comparing competing plans.  
 (B) Cumulative DVH shows the fractional volume of an organ receiving a certain dose or higher.  
 (C) Differential form of DVH shows the extent of dose variation within a given structure.  
 (D) The Differential DVH is used more commonly than Cumulative DVH in routine clinical practice.
076. Which of the following primary spinal canal tumors is intra dural but extra medullary in location?  
 (A) Hemangioma  (B) Meningioma  
 (C) Astrocytoma (D) Oligodendroglioma
077. Which of the following proteins is an inhibitor of osteoclast differentiation?  
 (A) Osteoprotegerin. (B) Interleukin 6.  
 (C) Transforming growth factor  $\beta$  (TGF- $\beta$ ). (D) Macrophage inflammatory protein 1a.
078. Which component of radiation damage can be modified by manipulation of the post irradiation conditions?  
 (A) Lethal damage. (B) Sub lethal damage.  
 (C) Potentially lethal damage. (D) Supra lethal damage.

079. A 63-year-old man with a history of smoking presents with hematuria. He undergoes transurethral resection (TUR), of a suspicious bladder growth seen on cystoscopy which reveals histological evidence of high-grade stage T1 superficial bladder cancer associated with CIS. What would be his risk of disease recurrence in the absence of adjuvant intra vesical therapy?
- (A) 10% (B) 30%  
(C) 50% (D) 70%
080. A left axillary lymph node involved by gastric cancer as a result of spread through intra thoracic lymph channels is called as -
- (A) Irish node (B) Virchow node  
(C) Rosenmuller node (D) Krause's node
081. All of the following are known to be risk factors for gastric cancer EXCEPT?
- (A) Helicobacter pylori infection  
(B) Cigarette smoking  
(C) Alcohol abuse  
(D) Previous gastric surgery for benign gastric ulcer disease
082. As per ACS guidelines which of the following profiles does not come under high risk criteria for developing breast cancer?
- (A) Women with a known BRCA mutation.  
(B) Untested women with a first-degree relative with a BRCA mutation.  
(C) Women with history of prior radiation to the chest for Hodgkin's disease.  
(D) Women with 10% lifetime risk of developing breast cancer based on specialized breast cancer risk estimation models.
083. A 65-year-old male with a history of non - metastatic loco regionally advanced Adenocarcinoma lung (EGFR and ALK mutation negative disease) recently treated with chemotherapy and awaiting sequential thoracic radiation with radical intent, presents with worsening breathlessness and facial edema. PET CT shows a recurrent mediastinal mass encircling the SVC causing SVC obstruction with no other evidence of metastasis. While being shifted for RT he develops altered sensorium and hypotension. What will be the ideal option to palliate SVC obstruction in this case?
- (A) Endovascular stenting  
(B) Emergency RT to mediastinum  
(C) Emergency thoracotomy and debulking surgery  
(D) Second line chemotherapy
084. Which of the following are high risk features in the post- operative pathology report for which adjuvant concurrent chemo radiation is recommended in head and neck cancers?
- (A) Tumor size > 5 cms.  
(B) More than 3 nodes positive and high grade disease.  
(C) Positive margin status and extra capsular extension.  
(D) Lympho-vascular invasion and Peri neural invasion.
085. Which of the following is a treatment goal of IMRT in head and neck cancer?
- (A) Parotid sparing with reduction in severity of xerostomia.  
(B) Deliver radical RT doses to level V neck nodes.  
(C) Avoiding a low-neck match in patients with a low-lying larynx.  
(D) All of the above.

086. According to cancer staging as per TNM 8<sup>th</sup> edition a lesion in the oral tongue > 2 cm but <4 cm in greatest dimension and depth of invasion <10 mm with single neck node of 4 cm size deeply fixed to muscle with ulceration of overlying skin of the neck is staged clinically as ?
- (A) cT2 N2a Mx (B) cT2 N3b Mx  
(C) cT3 N3 Mx (D) cT4a N2a Mx
087. In IMRT treatment of nasopharyngeal cancer which of the following is a dose constraint recommended for larynx?
- (A) Mean dose = 30 Gy  
(B) Dmax = 80Gy  
(C) D max should not exceed 105% of prescribed dose  
(D) All of the above
088. As per COG protocol, what is the radiation dose to be prescribed in Ewing's sarcoma of the long bones in children treated with induction chemo followed by radical RT?
- (A) 45 Gy to the pre chemotherapy disease extent and 55.8 Gy to the post chemotherapy residual disease.  
(B) 50.4 Gy to the pre chemotherapy disease extent and 55.8 Gy to the post chemotherapy residual disease.  
(C) 65 Gy to the pre and post-chemo disease extent.  
(D) 45 Gy to the pre chemotherapy disease extent and 50.4 Gy to the post chemotherapy residual disease.
089. Siewert's classification includes all of the following EXCEPT?
- (A) Is used in all squamous cell cancers involving the GE junction.  
(B) Siewert's type I tumors are considered as distal esophagus tumors.  
(C) Siewert's type II tumors are considered gastric tumors.  
(D) Siewert's type III tumors are considered gastric tumors.
090. A 42-year-old woman receives 4 cycles of carboplatin and paclitaxel for stage III ovarian cancer. Post chemo CT imaging reveals that the sum of longest diameters of all measurable lesions has decreased by 25%. What is the best assessment of her response to therapy as per RECIST criteria 1.0?
- (A) Complete response (B) Partial response  
(C) Progressive disease (D) Stable disease
091. Which one of the following factors is considered as the best predictor of metastatic risk in primary cutaneous melanoma?
- (A) Clark level (B) Breslow's thickness  
(C) Pattern of growth (D) Number of mitoses
092. All of the following conditions are known to increase the risk of developing hepatocellular carcinoma EXCEPT?
- (A) Viral hepatitis (Hepatitis B and C infection)  
(B) Autoimmune chronic active hepatitis  
(C) Alcoholic hepatitis  
(D) Schistosomiasis

093. Which of the following statements is **INCORRECT** regarding establishing histological confirmation from an unresectable mass in head of pancreas?
- (A) Histological confirmation is indicated in all patients with pancreatic mass.
- (B) Histological confirmation is indicated if neoadjuvant treatment is being planned.
- (C) Histological confirmation is indicated if a benign lesion is also a DD.
- (D) EUS with fine-needle aspiration (FNA) biopsy has accuracy of > 90% in establishing histological diagnosis in these patients.
094. Radiological criteria denoting locally advanced disease of head of pancreas and need for commencing neo adjuvant / palliative chemo-radiation include which of the following?
- (A) Tumor encasement of Superior Mesenteric Artery (> 180° invasion)
- (B) Tumor encasement of coeliac axis / hepatic artery
- (C) Superior Mesenteric Vein occluded and no option for reconstruction
- (D) All of the above
095. A 55-year-old asymptomatic male undergoes master health checkup when digital rectal examination reveals an enlarged prostate with a right lobe nodule. His serum PSA value is 3 ng /ml. He has never undergone PR exam or PSA testing previously. He is advised TRUS guided biopsy. What is the probability that his biopsy report will be positive for prostate malignancy?
- (A) 5%
- (B) 20%
- (C) 40%
- (D) 50%
096. Which among the Molecular subgroups of medulloblastoma has got worst prognosis?
- (A) WNT
- (B) SHH
- (C) Group 3
- (D) Group 4
097. In a patient who has undergone SRS for vestibular schwannoma with no evidence of tumor progression on follow up imaging which of the following cannot be considered as a reason for hearing loss following SRS treatment?
- (A) Transient conductive hearing loss resulting from serous otitis media.
- (B) Delayed sensorineural hearing loss because of direct radiation injury to the vestibulocochlear nerve or cochlea.
- (C) Compression of the vestibulocochlear nerve or internal auditory artery from tumor edema.
- (D) Thrombosis of the superior cerebellar artery.
098. Which molecular abnormality is uncommon in small-cell lung cancer?
- (A) MYC amplification
- (B) ROS 1 mutation
- (C) P53 inactivation
- (D) RB inactivation
099. Essential features required to establish a diagnosis of SIADH (Syndrome of Inappropriate Anti-Diuretic Hormone Secretion) include all the below EXCEPT?
- (A) Urine osmolality >100 mg/kg of water during hypotonicity
- (B) Clinical hypovolemia
- (C) Urine sodium >40 mmol/L with normal dietary salt intake
- (D) Normal thyroid and adrenal function
100. When is Tolvaptan NOT recommended in the management of hyponatremia in SIADH?
- (A) Treatment of mild hyponatremia
- (B) Treatment of moderate hyponatremia
- (C) Treatment of symptomatic hyponatremia
- (D) Treatment of severe asymptomatic hyponatremia

101. Hypertrophic Osteoarthropathy is associated with all the signs given below EXCEPT?  
 (A) Digital clubbing  
 (B) Radiological evidence of periostosis  
 (C) Synovial effusions  
 (D) Abnormal proliferation of the skin and osseous tissues at the proximal joints of extremities
102. Which of the following properties pertain to proton beams?  
 (A) Lack of an exit dose (B) Sharp beam profiles  
 (C) Lower integral doses (D) All of the above
103. Which of the following conditions is NOT an approved indication for SRS treatment?  
 (A) AV malformations (B) Schwannomas  
 (C) Initial treatment of GBM (D) Solitary brain metastasis less than 3 cm size
104. Radiating both the testes to a total dose of 8 Gy at 2 Gy per fraction will lead to which of the following effects?  
 (A) Loss of libido (B) Permanent Sterility  
 (C) Both (A) and (B) (D) Temporary sterility
105. Which of the following statements CORRECTLY relates radiation and growth factors?  
 (A) Radiation induces interleukin 3 and interleukin 4.  
 (B) Interleukin-1 acts as a radio protectant of hematopoietic cells.  
 (C) Fibroblastic growth factor promotes radiation induced micro vascular damage.  
 (D) Fibroblastic growth factor promotes radiation induced apoptosis.
106. Regarding the radiation tolerance of the spinal cord which of the following statements is INCORRECT?  
 (A) The spinal cord is an example of a structure where the functional sub units are arranged in serial manner.  
 (B) Radiation damage to spinal cord shows a binary response.  
 (C) Even if critical cells in any one segment die still the spinal cord can function normally.  
 (D) There exists a threshold radiation dose below which there is normal function and above which there is loss of function.
107. Based on Casarett's classification of mammalian tissue radio sensitivity the hepatic cells are classified under which group?  
 (A) Vegetative intermitotic cells. (B) Reverting post mitotic cells.  
 (C) Fixed post mitotic cells. (D) Differentiating intermitotic cells.
108. As per NCRP norms, what is the risk estimate for radiation induced carcinogenesis for the general population when exposed to low dose / low dose rate radiation?  
 (A) 10% per Sievert exposure (B) 1% per Sievert exposure  
 (C) 0.1 % per Sievert exposure (D) 5% per Sievert exposure
109. As per NCRP limits for occupational exposure for stochastic effects, what is the minimum age limit for occupational exposure to radiation?  
 (A) 18 years (B) 21 years  
 (C) 25 years (D) 30 years
110. What is the annual effective dose limit for adult family members exposed to a patient who has received radionuclide therapy, as per NRCP limits?  
 (A) 10 mSv (B) 50 mSv  
 (C) 20 mSv (D) 5 mSv

111. Which of the following statements is INCORRECT regarding radiation exposure limits as defined by ICRP?
- (A) The ICRP recommends for radiation workers a limit of 20 mSv (2 rem) per year averaged over defined periods of 5 years, with a limit in any year of 50 mSv (5 rem).
- (B) The ICRP recommends a limit of 2 mSv (200 mrem) to the surface of the abdomen for the remainder of pregnancy for a pregnant radiation worker.
- (C) ICRP recommends a monthly limit of 0.5 mSv (50 mrem) to the embryo or fetus.
- (D) As per ICRP, a person occupationally exposed from 18 to 65 years of age could receive a total dose of 940 mSv (94 rem).
112. What is the half-life of the radioactive isotope  $^{103}\text{Pd}$ ?
- (A) 59.4 days  (B) 17 days
- (C) 2.7 days (D) 7 days
113. Which of the following statements is CORRECT regarding VMAT treatment ?
- (A) VMAT is commonly used to refer to any arc therapy technique that uses fixed dose rate throughout the arc treatment.
- (B) VMAT treatment is much slower than conventional IMRT.
- (C) VMAT treatment delivers more MU in comparison to conventional IMRT.
- (D) The biggest advantage of a VMAT delivery is in its delivery efficiency.
114. Which of the following statements is INCORRECT regarding IMRT?
- (A) IMRT deliver lower integral dose.
- (B) IMRT treatment is associated with significant dose homogeneity within the PTV.
- (C) IMRT offers the potential of adaptive therapy.
- (D) IMRT allows simultaneous integration of boost plan.
115. A 40-year-old male working in a nuclear reactor is accidentally exposed to a high dose of radiation and he is subsequently planned for a bone marrow transplant as treatment for the same. At which dose of radiation exposure to whole body is such a transplant effective?
- (A) 1-2 Gy (B) 3-4 Gy
- (C) 8-10 Gy (D) 15-16 Gy
116. Which of the following factors increases the probability of cell kill by hyperthermia?
- (A) Acidic pH (B) Nutrient deficiency
- (C) Hypoxia  (D) All of the above
117. Cyclin B / CDK1 plays an important role in the transition of cells between which phases of cell cycle?
- (A) G0 into G1 (B) G1 into S
- (C) S into G2  (D) G2 into M
118. What is the main rationale behind using Accelerated fractionation in radiation treatment?
- (A) Enhances repair of normal tissues.
- (B) Improves oxygen perfusion to hypoxic cells.
- (C) Reduces tumor cell repopulation in rapidly proliferating tumors.
- (D) All of the above.
119. Which of the following genetic mechanisms is NOT involved in oncogene activation?
- (A) Retroviral integration  (B) Somatic homozygosity
- (C) Point mutation (D) Chromosomal rearrangement

120. Which one of the following genes is a tumor suppressor gene?  
 (A) NEU (B) MYC  
 (C) RAS (D) PTEN
121. Defects in mismatch repair proteins have been associated with which one of the following tumors?  
 (A) Hereditary non-polyposis colo-rectal cancer  
 (B) Neurofibromatosis  
 (C) Ovarian carcinoma of the serous type  
 (D) Retinoblastoma
122. It is believed that viral onco proteins E6 and E7 inactivate both p53 and pRb, thereby leading to the development of cancer. This process occurs after infection with which virus?  
 (A) Herpes simplex virus 1 (B) Human papillomavirus  
 (C) Epstein-Barr virus (D) Cytomegalovirus
123. Which of the following is a criteria used in the WHO classification of nasopharyngeal cancer?  
 (A) Presence of keratin (B) Presence of Mucin  
 (C) Cell type (D) Degree of anaplasia
124. Which of the following structures is a part of the glottis?  
 (A) Epiglottis (B) Arytenoids  
 (C) Inter arytenoid area (D) Aryepiglottic folds
125. What is the lymph node involvement risk in T2N0M0 glottic cancer at presentation?  
 (A) <1% (B) ≤5%  
 (C) 10% (D) 20%
126. Most prostate cancers arise from which part of the prostate gland?  
 (A) Peripheral region (B) Central zone  
 (C) Fibromuscular stroma (D) Transitional zone
127. Which of the following drugs is an anti-metabolite?  
 (A) Melphalan (B) Etoposide  
 (C) Mitomycin (D) Gemcitabine
128. Bortezomib inhibits activity of which of the following?  
 (A) Proteasomes (B) Tyrosine kinases  
 (C) Thymidylate synthase (D) mTOR(FRAP1)
129. Which of the following radionuclides used in cancer therapy is an alpha emitter?  
 (A) <sup>90</sup>Y (B) <sup>153</sup>Sm  
 (C) <sup>223</sup>Ra (D) <sup>177</sup>Lu
130. What is the dose rate used in Radio-Immunotherapy (RIT)?  
 (A) 2 to 5 cGy per hour (B) 10 to 20 cGy per hour  
 (C) 20 to 30 cGy per hour (D) 40 to 50 cGy per hour
131. Which of the following choices best describes the mechanism of action of the chemotherapeutic agent, Irinotecan?  
 (A) Inhibits Ribonucleotide reductase (B) Interferes with the action of Topoisomerase I  
 (C) Inhibits DNA helicases (D) Generates DNA crosslinks
132. What are the common side effects of Cisplatin 100mg/m<sup>2</sup> used in concurrent chemoradiation of head and neck squamous cell carcinoma?  
 (A) Rash, hypomagnesemia (B) Neurotoxicity, nephrotoxicity, ototoxicity  
 (C) Stomatitis, diarrhea (D) Alopecia, cardiomyopathy

133. Why are cancer stem cells (CSC) important targets of anti-cancer treatment?  
 (A) They are more resistant to therapeutic killing  
 (B) They have the ability to regenerate a tumor once therapy has been halted  
 (C) Both (A) and (B)  
 (D) None of the above
134. Which of the following therapies is recommended by FDA as initial monotherapy in metastatic renal cell carcinoma?  
 (A) Interferon (B) IL-2  
 (C) Bevacizumab  (D) Sunitinib
135. A study wishes to determine whether the drug has activity against the tumor type in question. This is an example of what kind of clinical trial?  
 (A) Pilot study (B) Phase I trial  
 (C) Single arm Phase II trial (D) Phase III trial
136. Which of the following drugs is an ALK tyrosine kinase inhibitor?  
 (A) Gefitinib (B) Erlotinib  
 (C) Afatinib  (D) Ceritinib
137. Which of the following drugs is approved in the management of Medullary cancer of thyroid?  
 (A) Dasatinib  (B) Vandetanib  
 (C) Axitinib (D) Everolimus
138. The major therapeutic advantage of fast neutron radiotherapy has been demonstrated in which of the following tumors?  
 (A) Salivary Gland tumors (B) Head and neck squamous cell carcinomas  
 (C) Gastric cancers (D) Breast cancer
139. Which of the following properties of Carbon ion therapy mentioned below is INCORRECT?  
 (A) They are high LET radiation  
 (B) They exhibit a phenomenon called spread out Bragg peak  
 (C) Associated with increase in integral dose  
 (D) Have a narrow penumbra
140. Which of the following statements concerning photodynamic therapy (PDT) is INCORRECT?  
 (A) The major cytotoxic pathway of PDT is through apoptosis.  
 (B) Tumor hypoxia limits PDT associated cytotoxicity.  
 (C) PDT can stimulate host immune response.  
 (D) PDT inhibits VEGF expression.
141. Which of the following drugs cannot be described as a hypoxic cell sensitizer?  
 (A) Misonidazole  (B) Ketoconazole  
 (C) Etanidazole (D) Nimorazole
142. Which of the following drugs is correctly matched with its mechanism of action?  
 (A) Tirapazamine - bio- reductive drug.  
 (B) Amifostine - oxygen mimetic hypoxic cell sensitizer.  
 (C) Carboplatin - Anti metabolite.  
 (D) Methotrexate - Alkylating agent.

143. The following statements regarding breathing Carbogen with RT are true EXCEPT?  
 (A) Carbogen is a mixture of 95% Oxygen and 5% Carbon dioxide.  
 (B) Carbogen breathing shifts the oxyhemoglobin association curve to the left.  
 (C) Carbogen breathing leads to a state of mild acidosis.  
 (D) Carbogen breathing improve tumor oxygenation and enhance RT response.
144. Which of the following is not a component of the neurohypophysis?  
 (A) Median eminence (B) Infundibular stem  
 (C) Neural lobe  (D) Pars distalis
145. Hypersecretion of pituitary hormones is seen in which of the following conditions?  
 (A) Sheehan syndrome (B) Simmonds disease  
 (C) Cushing disease. (D) Frohlich syndrome.
146. Radiation induced neuro-cognitive changes typically arise as a consequence of damage to which of the following cells?  
 (A) Axons (B) Neurons  
 (C) Oligodendrocytes (D) Dendrites
147. In which of the following choices given below are the various immune cells correctly arranged in the DESCENDING order of their radio sensitivity?  
 (A) Macrophages > T lymphocytes > B lymphocytes  
 (B) B lymphocytes > T lymphocytes > Macrophages  
 (C) T lymphocytes > B lymphocytes > Macrophages  
 (D) Macrophages > B lymphocytes > T lymphocytes
148. Which of the following statements regarding dose rate effect is CORRECT?  
 (A) The dose rate effect is the increase in biological effect of a dose seen at low dose rates and extended exposure times.  
 (B) The dose rate effect results from the repair of sublethal damage that occurs during a long radiation exposure.  
 (C) The magnitude of the dose-rate effect remains constant among different types of cells.  
 (D) The dose rate effect is most dramatic at dose rates above 12 Gy/min.
149. As per the law of Bergonie and Tribondeau, which of the following properties does NOT pertain to radiosensitive tissues?  
 (A) Their cells are well differentiated.  
 (B) Their cells have a greater proliferative capacity.  
 (C) Their cells divide more rapidly.  
 (D) Their cells are less differentiated.
150. Which of the following forces is mainly responsible for holding the nucleons together in the nucleus?  
 (A) Electromagnetic force  (B) Strong nuclear force  
 (C) Gravitational force (D) All of the above
151. Which of the following statements is a property of MR imaging?  
 (A) MRI provides best geometric accuracy.  
 (B) MRI is less susceptible to artifacts from patient movement.  
 (C) MRI is related to electron density and atomic number.  
 (D) MRI generates image sets in axial, sagittal, coronal, or oblique planes.

152. If the energy of an electron beam is increased for a treatment, what happens to the skin dose?  
 (A) Increases  (B) Decreases  
 (C) Remains constant  (D) None of the above
153. Which of the following statements does NOT pertain to Cyberknife?  
 (A) It is a miniaturized LINAC mounted on a robot.  
 (B) The target is tracked using two orthogonal diagnostic x-ray cameras and an optical tracking system.  
 (C) This system utilizes 10 MV X rays for radiation.  
 (D) Stereotactic frames are not normally used for targeting.
154. What is the radiation tolerance dose limit for the optic chiasma in single fraction SRS treatment?  
 (A) 12 Gy  (B)  $\leq 10$  Gy  
 (C) 14 Gy  (D) 16 Gy
155. Identify the rationale behind the concept of giving adjuvant radiotherapy followed sequentially by adjuvant chemotherapy?  
 (A) Spatial cooperation.  (B) Radiation sensitization.  
 (C) Protection of normal tissues.  (D) None of the above.
156. Mechanisms of radiation sensitization seen when Taxanes are combined with radiation include all EXCEPT?  
 (A) Cellular arrest in G2M phase of cell cycle.  (B) Induction of apoptosis.  
 (C) Reoxygenation of tumor cells.  (D) Inhibition of DNA synthesis.
157. Definitive primary concurrent chemo-radiation is NOT the standard of care in which of the following malignant conditions?  
 (A) Stage T2bN1M0 squamous cell carcinoma cervix  
 (B) Stage T2N1M0 squamous cell carcinoma hypopharynx  
 (C) Stage T2N1 M0 adenocarcinoma of stomach  
 (D) Stage T2 N1M0 squamous cell carcinoma of anal canal
158. Which of the following chemotherapeutic drugs is CORRECTLY matched with its long term toxicity?  
 (A) Actinomycin D – Hepatopathy  (B) Methotrexate – Ototoxicity  
 (C) Doxorubicin – Pulmonary fibrosis  (D) Bleomycin – Cardiomyopathy
159. Which of the following radiation procedures has a high risk (> 90% chance) of causing radiation induced emesis?  
 (A) Whole brain radiotherapy  (B) Total nodal radiation  
 (C) Craniospinal radiation  (D) Whole breast radiation
160. Which of the following check point inhibitors is NOT approved in the management of urothelial carcinoma?  
 (A) Avelumab  (B) Atezolizumab  
 (C) Durvalumab  (D) Ipilimumab
161. Which of the following isotopes is most commonly used for HDR brachy therapy?  
 (A) Ir-192  (B) Pd-103  
 (C) I-125  (D) Y-90
162. As per ICRU report 38 (1), HDR brachy therapy is defined as brachy therapy treatment delivered with which dose rate?  
 (A) 12 cGy/min or higher.  (B) 20 cGy/min or higher.  
 (C) 2 cGy/min or higher.  (D) 10 cGy/ min or higher.

163. Which of the following properties should ideally be possessed by a radioactive isotope for its use in HDR brachytherapy?
- (A) Larger source size (B) Short half life  
 (C) High specific activity (D) High photon energy
164. Motion control techniques used in radiotherapy fall under which of the below mentioned categories?
- (A) Dampening (B) Gating  
 (C) Tracking (D) All of the above
165. In patients undergoing partial liver radiation with conventional dose fraction of 1.8 to 2 Gy which of the following dose constraints is followed?
- (A) For the treatment of liver metastases, the mean dose to normal liver (liver minus GT V) should be <28 Gy.  
 (B) For the treatment of primary liver cancer, the mean dose to normal liver (liver minus GTV) should be <32 Gy.  
 (C) Both of the above  
 (D) None of the above
166. Which is the most common histological type of endometrial carcinoma?
- (A) Endometrioid adenocarcinoma (B) Papillary serous carcinoma  
 (C) Clear cell carcinoma (D) Mucinous carcinoma
167. All the following statements regarding the biology of type I endometrial cancers is correct EXCEPT?
- (A) They are usually indolent with low pathological grade.  
 (B) They are aggressive with extensive myometrial invasion.  
 (C) They show strong correlation with prior estrogen stimulation.  
 (D) They are seen in pre and peri- menopausal women.
168. A 65-year-old lady with an endometrial growth undergoes staging laparotomy. Her post op HPE suggests endometrioid adenocarcinoma stage pT1aN0M0 grade II, with LVI. What will be your advice on adjuvant treatment as per MSKCC protocol?
- (A) Observation  (B) Consider vaginal brachytherapy  
 (C) EBRT (D) EBRT + vaginal brachytherapy
169. Among the following cutaneous lymphomas which is an example of primary B cell cutaneous lymphoma as per WHO EORTC classification of cutaneous lymphomas?
- (A) Mycosis fungoides  
 (B) Sezary syndrome  
 (C) Primary cutaneous anaplastic large cell lymphoma  
 (D) Primary cutaneous marginal zone lymphoma
170. Regarding EORTC guidelines for technical aspects of TSEBT (Total Skin Electron Beam Therapy) which of the following statements regarding its dosimetry is CORRECT?
- (A) The 80% isodose line should extend to 4 mm below the skin surface.  
 (B) Dose at a depth of 1 cm from skin surface must be <20% of the maximum skin dose.  
 (C) The dose at curved skin sites must not exceed 105 % of the prescribed skin dose.  
 (D) All of the above.

171. In squamous cell cancer of head and neck, at what percentage risk of subclinical disease in neck nodes is elective radiation of the neck indicated along with definitive radiation of primary site?  
 (A) > 10% (B) > 40%  
 (C) > 15 -20% (D) > 30%
172. Which of the following thyroid cancers rarely concentrate iodine?  
 (A) Insular carcinoma (B) Medullary carcinoma  
 (C) Anaplastic carcinoma  (D) All of the above
173. What is the biological half-life of I - 131 in thyroid tissue?  
 (A) 8 days (B) 7.3 days  
 (C) 80 days (D) 12 days
174. Which of the following paraneoplastic syndromes occurs less frequently in Small cell lung cancer (SCLC)?  
 (A) Lambert-Eaton Myasthenic syndrome  (B) Hypercalcemia  
 (C) Cushing's syndrome (D) SIADH
175. Which of the following lymph node groups cannot be accessed by Endobronchial ultrasound guided transbronchial needle aspiration (EBUS TBNA)?  
 (A) Paratracheal (B) Sub carinal  
 (C) Hilar  (D) None of the above
176. Which is the most common cancer seen in patients suffering from Li Fraumeni syndrome?  
 (A) Breast cancer (B) Rhabdomyosarcoma  
 (C) Osteosarcoma (D) GBM
177. As per the recommendations made by ASTRO what is the radiation dose schedule advised for patients undergoing hypo fractionated whole breast RT without tumor bed boost following breast conservation surgery?  
 (A) 39 Gy in 13 #  (B) 42.5 Gy in 16 #  
 (C) 44 Gy in 11 # (D) 41.6 Gy in 13 #
178. In which of the following sarcomas is lymph node involvement more common?  
 (A) Clear cell sarcoma (B) Liposarcoma  
 (C) Malignant Fibrous Histiocytoma (D) Leiomyosarcoma
179. An 18-month-old child with type 1 neurofibromatosis presents with visual disturbance and has MRI evidence of bilateral optic nerve glioma. Her ophthalmology examination suggests preserved useful vision. What would you recommend as the ideal treatment modality for this child?  
 (A) Surgery (B) Radiotherapy  
 (C) Chemotherapy (D) Observation
180. What is the most appropriate post op radiation plan for a 6-year-old girl who has undergone maximal safe resection for a supratentorial anaplastic ependymoma with no radiological or cytological evidence of leptomeningeal seeding?  
 (A) No radiation  
 (B) 54 Gy to the CTV with 1cm margin followed by boost of 5 Gy if feasible  
 (C) 23.4 Gy to the craniospinal axis with a tumor bed boost to 54 Gy  
 (D) 36 Gy to the craniospinal axis with a tumor bed boost to 54 Gy
181. The highest spontaneous remission rate of any human neoplasm is seen in which of the following malignancies?  
 (A) Melanomas (B) Renal Cell carcinoma  
 (C) Lymphomas  (D) Neuroblastoma

182. Neuroblastomas are associated with all of the following EXCEPT?
- (A) Horner's syndrome (B) Opsoclonus myoclonus syndrome  
(C) Blueberry Muffin sign (D) Denys Drash syndrome
183. Which of the following sites is considered a favorable site for rhabdomyosarcoma?
- (A) Infratemporal fossa (B) Nasopharynx  
(C) Scalp (D) Nasal cavity
184. Which of the following muscles is an intrinsic muscle of the tongue?
- (A) Genioglossus (B) Lingual muscle  
(C) Hyoglossus (D) Styloglossus
185. The expression of which cytokine is elevated in radiation induced pneumonitis?
- (A) Transforming growth factor- $\beta$  (TGF- $\beta$ ) (B) Tumor necrosis factor- $\alpha$  (TNF- $\alpha$ )  
(C) NF-kappa B (NF-kB) (D) Interleukin-6 (IL-6)
186. According to the AJCC 8th edition staging manual, a patient with a p16-positive base of tongue squamous cell carcinoma lesion measuring 3 cm x 1cm with contralateral mobile level II cervical node measuring 4 cm in size will be grouped under which stage?
- (A) Stage I (B) Stage II  
(C) Stage III (D) Stage IV a
187. International Prognostic Index (IPI) score used to prognosticate Diffuse Large B Cell Lymphoma considers all the following risk factors EXCEPT?
- (A) Age (B) LDH level  
(C) Hemoglobin level (D) Performance status
188. What tumors have shown the shortest median latent period for radiation-induced malignancies?
- (A) Breast (B) Leukemia  
(C) Lung (D) Brain
189. The exposure of growing cartilage to radiation leads to irreversible growth deficit at which dose?
- (A) 10-15Gy (B) 12-15Gy  
(C) >30Gy (D) >20Gy
190. What is the dose limiting toxicity of Oxaliplatin?
- (A) Sensory neuropathy (B) Nephrotoxicity  
(C) Ototoxicity (D) Thrombocytopenia
191. A 58-year-old woman with no comorbidities undergoes colonoscopy for hematochezia, which reveals a growth in the anterior wall of distal rectum 3.5 cms from anal verge. No other proximal lesions are seen in colonoscopy. Biopsy of the rectal growth is suggestive of adenocarcinoma. MRI of the pelvis confirms growth distal rectum with peri rectal stranding with a few significant mesorectal nodes and absence of pelvic nodes. Metastatic work up shows no systemic spread. How should her disease be treated?
- (A) APR followed by appropriate adjuvant therapy.  
(B) FOLFOX based neoadjuvant chemotherapy followed by appropriate surgery.  
(C) Pre op chemo-radiation followed by assessment for surgery.  
(D) Primary radical RT only.

192. The American Association for the Study of Liver Diseases (AASLD) non invasive criteria for diagnosis of Hepatocellular carcinoma includes all the following EXCEPT?
- (A) Radiological size of liver lesion > 2cm  
 (B) Lesion should exhibit arterial hyper enhancement and venous washout in one single imaging modality  
 (C) Serum AFP > 200 ng / ml  
 (D) Serum AFP > 500 ng / ml
193. In a patient undergoing radical IMRT for localized high-risk prostate cancer with a dose per fraction of 1.8 Gy to 2 Gy which of the following dose constraints used for rectum as per QUANTEC is INCORRECT?
- (A) V 50 should be limited to <50% (B) V 60 should be limited to <35%  
 (C) V 65 should be limited to <30% (D) V 75 should be limited to <15%
194. In a patient undergoing radical IMRT for a squamous cell carcinoma of anterior tongue with a dose per fraction of 1.8 Gy to 2 Gy which of the following dose constraints used for salivary glands as per QUANTEC is CORRECT?
- (A) Mean dose to both parotids should be < 25 Gy  
 (B) Mean dose to one parotid should be < 30 Gy  
 (C) Mean dose to submandibular glands should be < 25 Gy  
 (D) All of the above
195. Which of the following is not considered as a high-risk factor for CNS disease in ALL?
- (A) Elevated LDH at diagnosis (B) Elevated WBC count at diagnosis  
 (C) B cell ALL (D) Traumatic lumbar tap
196. Which of the following commercial devices does not represent radiotherapy equipment used in IORT (Intra Operative Radiotherapy)?
- (A) MOBETRON (B) ZEISS  
 (C) XOFT (D) XOFIGO
197. Regarding lymphatic drainage of the testes which of the statements is CORRECT?
- (A) The landing zone for metastasis from the left testicle is in the interaortocaval lymph nodes.  
 (B) The landing zone from the left testicle is in the pre and para-aortic lymph nodes just inferior to the left renal vessels.  
 (C) The landing zone from the right testicle is in the pre and para-aortic lymph nodes.  
 (D) None of the above.
198. As per scoring system proposed by Mirel, prophylactic surgical fixation of femur affected by metastatic disease is indicated at which score?
- (A)  $\geq 15$  (B)  $\geq 12$   
 (C)  $\geq 9$  (D)  $\geq 6$
199. For a patient suspected to have metastatic spinal cord compression what is the preferred imaging modality?
- (A) MRI whole spine with or without contrast  
 (B) CT whole spine  
 (C) Myelogram  
 (D) Bone scan
200. For a AVM  $\leq 3$  cm in size treated with SRS, what is the obliteration rate at 3 years?
- (A) 50% (B) 80%  
 (C) 70% (D) 90%