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Buy Course: Health Risks from Exposure to Low Levels of Ionizing Radiation
Test Questions
(hint: print questions & mark answers before starting online test)

Chapter 1

1. Ionizing radiation has the ability to do which of the following?
A. to displace electrons
B. break chemical bonds
C. repair DNA molecule
D. A and B only

2. Which of the following are considered as charged particles?
A. high-energy electrons
B. protons
C. Alpha particles or fast heavy ions
D. All of the above

3. What is LET stands for?
A. Low Energy Transfer
B. Linear Energy Transfer
C. Live Energy Transfer
D. None of the above

4. X-rays are what type of radiation?
A. Electromagnetic
B. Thermal
C. Chemical
D. Mechanical

5. The absorption and scattering of photons depends on their _____
A. atomic number
B. electron shells
C. energy
D. states

6. Higher-energy γ-rays, up to _____, can be generated by inelastic scattering, as occurred in the neutron-nitrogen interaction from the atomic bomb explosions in Hiroshima and Nagasaki.
A. 10 MeV
B. 7 MeV
C. 2 MeV
D. 1 MeV

7. X-rays are produced by deceleration of which of the following?
A. Electrons
B. Protons
C. Neutrons
D. All of the above

8. Conventional X-rays, used for diagnostic radiology, are commonly produced with accelerating voltages of about_____.
A. 20 kV
B. 200 kV
C. 2,000 kV
D. 2 kV

9. Which of the following is/are energy transfer process/es of photons that can cause biological damage?

A. The photoelectric process
B. Compton scattering
C. Pair production
D. All of the above

10. _____ is a measure of the energy transferred to material as an ionizing particle travels through it. This measure is used to quantify the effects of ionizing radiation on biological specimens.
A. Linear energy transfer (LET)
B. Radiolysis of water
C. Relative biologic effectiveness (RBE)
D. Oxygen enhancement ratio (OER)

11. X-rays are low LET radiation.
A. True
B. False

12. _____ is a measure of the capacity of a specific ionizing radiation to produce a specific biological effect.
A. Linear energy transfer (LET)
B. Radiolysis of water
C. Relative biologic effectiveness (RBE)
D. Oxygen enhancement ratio (OER)

13. As linear energy transfer (LET) increases, how is relative biologic effectiveness (RBE) affected?
A. with an increases in LET, RBE also increases
B. with an increase in LET, RBE decreases
C. with an increase in LET, RBE is neutralized
D. RBE is not affected by LET

14. According to the 1986 dosimetry system, DS86, only a small fraction of the absorbed dose to atomic bomb survivors was due to neutrons—about _____% in Hiroshima in the most relevant dose range and _____% in Nagasaki.
A. 1, 0.5
B. 2, 0.7
C. 3, 0.8
D. 4, 0.9

15. The likely site of health effects of low-dose radiation is the _____ material, which directs the structure and unction of the organism.
A. chemical
B. organic
C. inorganic
D. genetic

16. Radiation can damage DNA that can result in which of the following?
A. cell lethality
B. impaired cell function
C. producing carcinogenic process
D. All of the above

17. When x-rays interacts with DNA molecule (direct effect), it can cause which of the following?
A. cell lethality
B. strand breaks
C. damaged bases
D. B and C only

18. Interaction between water and x-rays can cause what type of effect?
A. organic
B. direct
C. indirect

D. All of the above

19. Water molecules make up _____ % of human tissue.
A. 60
B. 70
C. 80
D. 90

20. When the ionized water molecule collides with another water molecule, it reacts to produce a highly reactive _____, OH•, according to the reaction.
A. hydroxyl radical
B. ions
C. electron pairs
D. unstable atom

21. _____ is considered as the most important target for biological damage that leads to health effects.
A. Cell
B. Oxygen
C. Water
D. DNA

22. Which of the following is/are background radiation?
A. radon
B. cosmic rays
C. terrestrial γ-radiation and natural radioisotopes in the human body
D. All of the above

23. Collectively, background radiation is responsible for delivering an average effective dose per person worldwide of about _____ mSv per year.
A. 3.4
B. 2.4
C. 4.4
D. 5.4

24. Ionizing radiation produces which of the following types of DNA damage?
A. SSBs and DSBs in DNA chains
B. DNA-DNA covalent cross-links and DNA-protein covalent cross-links
C. large variety of oxidative changes in the nucleotide bases
D. All of the above

25. DNA damage from ionizing radiation can be repaired by which of the following mechanisms?
A. base-excision repair
B. nucleotide-excision repair
C. molecular repair
D. A and B only

Chapter 2
26. For low-LET radiation an absorbed dose of _____Gy1 (1000 mGy) corresponds to an equivalent dose of 1 Sv (1000 mSv).
A. 1
B. .01
C. .001
D. .0001

27. What is the maximum permissible dose that is recommended in the United States by the National Council on Radiation Protection and Measurements (NCRP) for general population from medical applications?
A. 4 mSv per year
B. 3 mSv per year
C. 2 mSv per year

D. 1 mSv per year

28. When an irradiated cell have an effect on a nearby unirradiated cell is called _____ effect.
A. bystander
B. spontaneous
C. direct
D. none of the above

29. Which of the following factors may affect the theoretical dose-response relationships?
A. variations in radiosensitivity during the cell cycle
B. induction of an adaptive response to an initial exposure
C. a bystander effect
D. All of the above

30. Aberrations formed following irradiation of cells in the G0/G1 phase of the cell cycle are called what?
A. dicentric exchanges
B. centric rings
C. monocentric exchanges or translocations
D. All of the above

31. Which of the following is an important feature of the chromosomal response to radiation during which initial DNA damage is fixed and then expressed in the form of aberrations such as dicentric chromosomes?
A. Preirradiation period
B. Postirradiation period
C. Mitotic period
D. None of the above

32. Ionizing radiation is known to induce a broad range of potentially mutagenic lesions in DNA ranging from damaged DNA bases to frank DNA breaks and chemically complex lesion clusters.
A. True
B. False

33. Which of the following defines the manifestation of genetic damage in a certain fraction of irradiated cells over many cell cycles after they were irradiated?
A. Preirradiation period
B. Postirradiation period
C. Radiation-induced genomic instability
D. None of the above

34. Which of the following phase is the most radiosensitive?
A. mitosis or late G2
B. G1
C. middle to late S phase
D. early G2

35. According to the research dose-response relationship over a range of 20-200 mGy is generally _____ and not affected significantly by either an adaptive or a bystander effect.
A. non-linear
B. linear
C. quadratic
D. None of the above

Chapter 3
36. Which of the following term is used to describe the process of cancer development?
A. Malignancy
B. Staging process
C. Growth regulation
D. Tumorigenesis

37. Radiation-induced cancers are unique or specifically identifiable when compared to other carcinogenic agents.
A. True
B. False

38. Which of the following are the critical mutational targets for cellular entry for tumor initiation phase?
A. gatekeeper genes
B. recovery genes
C. mutating genes
D. All of the above

39. Tumor development process includes which of the following steps?
A. tumor initiation
B. tumor promotion
C. malignant conversion and malignant progression
D. All of the above

40. When cancerous cells invade surrounding normal tissues and spread to distal site is called _____.
A. metastasis
B. tumor initiation
C. malignant conversion
D. None of the above

41. Which of the following is the gatekeeper gene for colon carcinoma?
A. NF1
B. VHL
C. APC
D. PTCH

42. _____ play roles in the maintenance of genomic integrity.
A. Caretaker genes
B. Radioactive genes
C. Mutated genes
D. None of the above

43. The gene and chromosomal mutations of the general types induced by ionizing radiation are known to play a role throughout the multistep development of tumors.
A. True
B. False

44. _____ of tumorigenesis have also proved to be instructive about the nature of radiation-associated early events in tumor induction.
A. Human experiments
B. Atomic bomb studies
C. Mouse genetic models
D. None of the above

45. The spontaneous development of tumors is frequently accompanied by the acquisition of _____ that serve to promote the mutational evolution of more aggressive neoplastic clones.
A. bystander genes
B. genomic instability phenotypes
C. immunoprotected chromosomes
D. none of the above

46. Which of the following are considered to be substantially more effective than low-LET radiation in inducing chromatid instability?
A. Alpha particles
B. Magnetic fields
C. Radiopharmaceuticals

D. None of the above

47. Any critical analysis of quantitative data on radiation-induced cancer requires informed selection of data sets.
A. True
B. False

48. Most evidence suggests that relatively high doses of radiation are necessary to induce skin tumors in humans and that these effects can be enhanced by exposure to UV light from the_____.
A. Radon
B. Sun
C. Laser beam
D. Uranium

49. Which of the following animals are used more often in lab experiment for radiation-induced skin cancer due to its skin sensitivity to tumor?
A. mice
B. rats
C. hamsters
D. humans

50. Radiation-induced bone cancer follows which of the following response?
A. threshold
B. nonthreshold
C. quadratic
D. non-quadratic

51. The Fractionation Kinetics approach is used to examine which of the following?
A. metastasis
B. tumor initiation
C. malignant conversion
D. repair of carcinogenic injury

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52. Ionizing radiation reduces the life-span of animals.
A. True
B. False

53. Which of the following approaches are used in an experiment for weighing he risks of low-dose radiation?
A. deliver radiation doses at different dose rates
B. develop dose-response relationships following acute, fractionated, and low-dose-rate exposures
C. deliver radiation dose of fast neutrons
D. A and B only

54. The development of molecular genetic techniques started in the _____.
A. 1970s
B. 1980s
C. 1990s
D. none of the above

55. Published genetic catalogs show that around _____of recorded human disorders and mutant genes have some degree of association with neoplastic disease.
A. 4%
B. 5%
C. 6%
D. 7%

56. The majority of human genetic diseases associated with DNA damage response and repair fall into which

of the following category?
A. Autosomal Dominant Disorders
B. Autosomal Recessive Disorders
C. *RADIATION-INDUCED CANCER*
D. None of the above

57. Which of the following is an example of Autosomal Recessive Disorders of DNA Damage Response?
A. Colorectal cancer
B. Leukemia
C. Renal cancer
D. Medulloblastoma

58. Which of the following is an example of Autosomal Dominant Disorders of Tumor Suppressor Genes, Proto-oncogenes, and DNA Damage Response or Repair Genes?
A. Colorectal cancer
B. Leukemia
C. Renal cancer
D. Both A and C

59. A carrier of a germline mutation in a given tumor-suppressor gene will however show loss of function of one such gene copy, thus "unshielding" the second copy in all target somatic cells.
A. True
B. False

60. The risk calculation of radiogenic breast cancer in normal individuals was based on data from_____.
A. Japanese atomic bomb survivors
B. Lab experiments
C. Mammographic patient data
D. Chernobyl disaster data

61. Which of the following genes have been identified as the principal genetic determinants of the 2-5% of breast cancer?
A. APC and VHL
B. WT1 and NF-1
C. BRCA1 and BRCA2
D. NF-2 and PTC

62. Which of the following data set has some association with breast cancer risk after radiation exposure?
A. heterozygous carriers of the *ATM* mutation of the highly radiosensitive disorder AT
B. inheritance of chromosomal radiosensitivity and its association with breast cancer risk
C. patients' age, ethnicity and economic status
D. Both A and B

63. It has already been noted that _____ play a crucial role in cellular responses to radiation and that major germline deficiencies in these genes can lead to heritable predisposition to cancer.
A. DNA repair genes
B. Chemotherapy
C. Radiation therapy
D. None of the above

64. Cancer is a multi-factorial set of diseases, and as such, there is expected to be a complex interplay between multiple germ-line genes and a plethora of other host- and environment-related factors.
A. True
B. False

65. Quantitative animal data on dose-response relationships provide a complex picture for low-LET radiation, with some tumor types showing linear or linear-quadratic relationships while other studies are suggestive of a low-dose threshold, particularly for thymic lymphoma and ovarian cancer.
A. True

B. False

Chapter 4

66. Naturally occurring _____ in somatic and germ cells contribute respectively to cancers and heritable genetic diseases.
A. growth
B. proliferation
C. chemical secretion
D. mutations

67. In 1927, Muller discovered the mutagenic effects of X-rays in_____.
A. barley and maize
B. mice
C. fruit flies
D. rats

68. Widespread and serious concern over the possible adverse genetic effects of exposure of large numbers of people to low levels of radiation first arose in the aftermath of _____.
A. Hiroshima and Nagasaki bombing
B. Tsunami disaster
C. Fukushima disaster
D. Chernobyl disaster

69. Which of the following committee was established to do research on genetic effects of radiation from Hiroshima and Nagasaki bombing?
A. NRC
B. Atomic Bomb Casualty Commission (ABCC)
C. UNSCEAR
D. All of the above

70. Which of the following body/ies have continued their work up to the present, periodically reviewing the levels of radiation to which human populations are exposed and improving assessment of the somatic and genetic risks of radiation exposure?
A. UNSCEAR
B. ARRT
C. BEIR
D. Both A and C

71. UNSCEAR and BEIR used which of the following data to predict the radiation risk of genetic disease in humans?
A. lab rats data
B. human experiments
C. mouse data
D. All of the above

72. Which of the following germ cells in male are sensitive to the effects of radiation and can carry genetic mutation?
A. spermatogonia
B. oocytes
C. erythrocytes
D. bone marrow cells

73. Which of the following germ cells in female are sensitive to the effects of radiation and can carry genetic mutation?
A. spermatogonia
B. oocytes
C. erythrocytes
D. bone marrow cells

74. The germ cells go through which of the following process to grow and sequence of nuclear changes?
A. meiosis
B. mitosis
C. proliferation
D. growth cycle

75. The concept of radiation-inducible genetic diseases is based on which of the following established facts?
A. hereditary diseases result from mutations that occur in germ cells
B. hereditary diseases result from mutations that occur in somatic cells
C. ionizing radiation can induce similar changes in all experimental systems adequately investigated
D. Both A and C

76. Diseases caused by mutations in single genes are known as _____.
A. chronic diseases
B. somatic diseases
C. Mendelian diseases
D. All of the above

77. Which of the following is an example of autosomal dominant disease?
A. Achondroplasia and Neurofibromatosis
B. Marfan syndrome
C. Myotonic dystrophy
D. All of the above

78. Which of the following autosomal recessive diseases requires two mutant genes at the same locus, one from each parent?
A. Achondroplasia and Neurofibromatosis
B. Marfan syndrome
C. Myotonic dystrophy
D. Cystic fibrosis

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79. Which of the following factors play an important role in multifactorial disease etiology
A. Environmental determinants
B. Genetic determinants
C. Socioeconomic determinants
D. Both A and B

80. Which of the following conditions are examples of multifactorial diseases?
A. neural tube defects and cleft lip
B. congenital heart defects
C. chronic diseases of adults (coronary heart disease, essential hypertension, and diabetes mellitus)
D. All of the above

81. The chromosomal diseases arise from which of the following?
A. structural abnormalities of chromosomes
B. numerical abnormalities of chromosomes
C. Environmental determinants
D. Both A and B

82. _____ is the amount of radiation required to produce in a generation as many mutations as those that arise spontaneously.
A. The doubling dose (DD)
B. Lethal dose (LD)
C. Partial dose
D. Whole body dose

83. The _____ assumes that the stability of mutant gene frequencies in a population is the result of the

existence of a balance between the rates at which spontaneous mutations enter the gene pool in every generation and the rate at which they are eliminated by natural selection.
A. population genetic theory
B. radiation sensitivity theory
C. radiotherapeutic theory
D. none of the above

84. The amount of increase in mutation frequency, the time it takes for the population to reach the new equilibrium, and the rate of approach to equilibrium are all dependent on which of the following?
A. Induced mutation rates
B. Intensity of selection and type of genetic disease
C. Whether the radiation exposure occurs in one generation only or generation after generation
D. all of the above

85. The multifactorial diseases include which of the following?
A. Congenital abnormalities present at birth
B. Chronic diseases
C. Thyroid cancers
D. Both A and B

86. The BEIR V report (NRC 1990) and the UNSCEAR (1993) report assessed the baseline prevalence of chromosomal diseases to be of the order of about 15% in live births.
A. True
B. False

87. The **most** spontaneous mutations arise as a result of errors in _____.
A. neurotransmitters
B. immune system
C. DNA replication
D. none of the above

88. Which of the following are the advantages of using human spontaneous mutation rates for DD calculations?
A. they pertain to human disease-causing genes
B. they are averaged over both sexes (male and female)
C. human geneticists count all mutants that arise anew irrespective of whether they were part of a cluster or not
D. All of the above

89. The data from female mice have not been used because there is uncertainty about whether mouse immature oocytes are a good model for assessing the mutational radiosensitivity of human immature oocytes.
A. True
B. False

90. Spontaneous mutations arise in each generation at a finite rate, and most are eliminated sooner or later by _____.
A. lymphatic system
B. natural selection
C. white blood cells
D. none of the above

91. Which of the following disease is due entirely to germline mutations?
A. Apert's syndrome
B. Crouzon's syndrome
C. Osteogenesis imperfecta
D. all of the above

92. When the population sustains radiation exposure, the mutation rate is increased, which in turn will impact disease frequency.

A. True
B. False

93. About _____% of retinoblastoma cases are due to germline mutations and the remaining ones are sporadic.
A. 40
B. 60
C. 77
D. 83

94. The larger the sporadic component, the smaller is the _____.
A. Survival rate
B. Prognosis rate
C. Mutation Component (MC)
D. None of the above

95. For a permanent increase in mutation rate, the Mutation Component (MC) for both X-linked and autosomal recessive diseases progressively increase to reach a value of 1.0 at the new equilibrium.
A. True
B. False

96. For most multifactorial diseases, the knowledge of which of the following remains limited?
A. number of genes involved
B. types of mutational alterations
C. nature of environmental factors
D. all of the above

97. As a first approach to the problem of estimating Mutation Component (MC) for multifactorial diseases, an ICRP (1999) Task Group developed a _____.
A. threshold level
B. non-threshold exposure chart
C. hybrid model
D. none of the above

98. The most important conclusion from computer simulation studies is that when the population is exposed to small doses of radiation in every generation, the MC for chronic diseases is very small, being of the order of _____% in the first several post-radiation generations including the first.
A. 1 to 2
B. 10-15
C. 16-20
D. 25-40

99. According to the research data, if the population sustains radiation exposure in one generation only, the increase in MC will be transient and small, followed by a progressive decline to zero.
A. True
B. False

100. _____ on rates of induced mutations (incorporated in the DD estimate) provide the basis for genetic risk prediction in humans.
A. World War II data
B. Occupational exposure data
C. Mouse data
D. None of the above

101. A total of _____ genes involved in autosomal dominant (59), or X-linked (8) recessive diseases was included in the potential recoverability correction factor (PRCF) analysis.
A. 67
B. 75
C. 89

D. 94

102. The recoverability of induced recessive mutations is also subject to constraints imposed by which of the following underlying genes factor?
A. structure
B. function
C. genomic contexts
D. all of the above

103. Development of the PRCF concept represents an example of how advances in human molecular biology and radiation genetics can be integrated for the purpose of genetic risk assessment.
A. True
B. False

104. For historical reasons, over the past four decades or so, the focus in the assessment of adverse genetic effects of radiation has been on the risk of inducible _____.
A. autoimmune infections
B. environmental diseases
C. genetic diseases
D. respiratory diseases

105. Ionizing radiation produces genetic damage by random deposition of energy; the predominant type of radiation-induced genetic change is a DNA deletion, often encompassing more than one gene.
A. True
B. False

106. Naturally occurring human congenital abnormalities are classified as a subgroup of multifactorial diseases, whereas radiation-induced ones generally are predicted to show autosomal dominant patterns of _____.
A. somatic diseases
B. inheritance
C. neurotransmitters
D. none of the above

107. Since the mid- _____, several studies have been carried out on the induction of germ cell mutations at expanded simple tandem repeat (ESTR) loci in mice and at minisatellite loci in humans.
A. 1960s
B. 1970s
C. 1980s
D. 1990s

108. Which of the following provided evidence that mutations at minisatellite loci can be induced by radiation in human germ cells?
A. Post-Chernobyl studies in Belarus
B. Post-Chernobyl studies in Ukraine
C. Nuclear test site study in Kazakhstan
D. all of the above

109. Which of the following is now used to calculate the doubling dose, which was also the case in the NRC (1972) report?
A. Human data on spontaneous mutation rates
B. Mouse data on induced mutation rates
C. Cancer death rates
D. Both A and B

110. Since the 1990 BEIR V Report, for *autosomal recessive diseases*, mutation component (MC) in the first few generations is close to _____%.
A. 0
B. 10

C. 18
D. 37

111. Which of the following disease class-specific factor has been introduced in the risk equation to bridge the gap between radiation-induced mutations in mice and the risk of radiation-inducible genetic disease in human live births?
A. Prognosis outcome
B. **Potential recoverability correction**
C. Treatment survival rates
D. None of the above

112. The concept that the adverse effects of radiation-induced genetic damage in humans are likely to manifest predominantly as multisystem developmental abnormalities in the progeny of irradiated individuals has now been introduced in the field of genetic risk estimation.
A. True
B. False

113. The mouse data used to obtain a provisional estimate of the risk of developmental abnormalities pertain to which of the following?
A. radiation-induced dominant skeletal abnormalities
B. dominant cataract mutations
C. congenital abnormalities ascertained *in utero*
D. all of the above

114. Under conditions of continuous radiation exposure in every generation, the risk to the second post radiation generation progeny is slightly lower for autosomal dominant and X-linked diseases and for congenital abnormalities.
A. True
B. False

115. The genetic studies of _____ carried out in Japan represent the largest and most comprehensive of the long-term human studies ever carried out on adverse hereditary effects of radiation.
A. post-Chernobyl studies
B. mouse data on induced mutation rates
C. atomic bomb survivors
D. none of the above

116. The average spontaneous mutation rate (the numerator in DD calculations) is based on _____ human disorders encompassing some 135 genes.
A. 26
B. 39
C. 43
D. 57

117. For autosomal dominant and X-linked diseases, a range of PRCFs from _____ was used, the lower limit of the range being a weighted average and the upper limit, the unweighted average (*i.e.*, proportion of genes at which induced mutations are potentially recoverable in live births).
A. 0.15 to 0.30
B. 1 to 2.5
C. 3 to 4.5
D. 5.6 to 7

118. Assessment of the relative importance of genetic and environmental factors in the _____ of multifactorial diseases is essential to explain their transmission patterns and predict their risks of recurrence in families.
A. chemistry
B. biology
C. etiology
D. prognosis

119. The concept of disease liability enables one to envisage a graded scale of the degree of being affected or being normal.
A. True
B. False

120. Which of the following is a basic assumption of the simple or standard version of the multifactorial threshold model (MTM)?
A. all environmental and genetic causes can be combined into a single continuous variable called liability
B. liability is determined by numerous genetic and environmental factors that act additively
C. liability in the population has a normal (Gaussian) distribution and it exceeds a certain threshold in affected individuals
D. all of the above

121. In quantitative genetics, the relative contributions of genetic and environmental factors to the overall phenotypic variation are assessed by analysis of variance.
A. True
B. False

122. _____ is the component attributable to the average effect of genes considered singly, as transmitted in the gametes.
A. Multifactorial threshold model
B. Additive genetic variance
C. Etiology
D. None of the above

123. Spontaneous mutations arise through several different mechanisms, and most are dependent on the _____ of the genes and their genomic context.
A. chemical balance
B. cellular structure
C. DNA sequence organization
D. none of the above

124. The radiation-induced mutations originate through _____ deposition of energy in the cell.
A. random
B. targeted
C. specific
D. none of the above

Chapter 5
125. _____ is the study of the distribution and determinants of disease prevalence in humans.
A. Oncology
B. Epidemiology
C. Anthropology
D. Microbiology

126. A basic comparison used in radiation epidemiology is to measure the rate of a specific disease among persons who have been exposed to radiation and among persons who have not.
A. True
B. False

127. Which of the following types of risks factors used in Epidemiology studies?
A. Absolute risk
B. Excess absolute risk
C. Relative risk
D. All of the above

128. Which of the following term is the ratio of the rate of disease among groups having some risk factor, such as radiation, divided by the rate among a group not having that factor.

A. Doubling risk
B. Deterministic risk
C. Relative risk
D. Absolute risk

129. Which of the following is the most critical and important feature of data collection, analysis, and interpretation in any science?
A. comparability
B. compatibility
C. implacability
D. contrast

130. The majority of the research studies relevant to the evaluation of radiation risks in human populations are classified as _____.
A. experimental
B. observational
C. controlled environment
D. none of the above

131. Which of the following basic strategies are used to select participants in an observational epidemiologic study that assesses the link between exposure to radiation and disease outcome?
A. selection of exposed people
B. looking at subsequent occurrence of disease or selecting diseased people
C. looking at their history of exposures
D. All of the above

Chapter 6
132. About how many survivors of the atomic bombings in Hiroshima and Nagasaki, Japan, in 1945 have been studied by the Radiation Effects Research Foundation (RERF) and its predecessor, the Atomic Bomb Casualty Commission?
A. 50,000
B. 120,000
C. 300,000
D. 500,000

133. Which of the following was the first cancer to be linked with radiation exposure in Atomic bomb survivors and has the highest relative risk of any cancer?
A. Thyroid cancer
B. Radiation induced cataracts
C. Leukemia
D. Lung cancer

134. According to the study of Atomic bomb survivors, the thyroid cancer risks depend on which of the following factor at the time of radiation exposure?
A. Age
B. Sex
C. Current health status
D. Weight

135. Which of the following is the most common type of cancer in Japan and, specifically, in the Life Span Study (LSS) cohort?
A. Stomach
B. Liver
C. Lung
D. Bone

136. The cancer incidence data from both the Hiroshima and the Nagasaki tumor registries became available for the first time in which of the following year?
A. the 1960s

B. the 1970s
C. the 1980s
D. the 1990s

Chapter 7
137. Approximately which of the following percentage of patients receive radiation therapy for cancer treatment in the United States?
A. 40
B. 50
C. 60
D. 70

138. _____ can provide crucial information on radiation exposure and biological risks.
A. Radiation therapy
B. MRI studies
C. Ultrasound studies
D. All of the above

139. The medical radiation studies provide a unique opportunity to address which of the following issues?
A. Effects of different radiation types and potential risk modifiers
B. Risk of specific tumor types
C. Possible genetic susceptibility to radiation-induced cancer
D. All of the above

140. How much radiation dose a patient receives during conventional chest x-ray?
A. 3-10 mGy
B. 0.02-10 mGy
C. 5-15 mGy
D. 3-14 mSv

141. A patient receives dose of 3-10 mGy during which of the following radiography contrast procedure?
A. GI series
B. Barium enema
C. Intravenous urogram
D. All of the above

142. _____ procedure for head injuries can expose patients to 5-15 mGy dose of radiation.
A. Computed tomography
B. MRI studies
C. Ultrasound studies
D. Nuclear Medicine

143. Which of the following circumstances require the use of medical radiation?
A. treatment of benign disease
B. diagnostic examination
C. treatment of malignant disease
D. All of the above

144. Roentgen discovered X-rays in _____.
A. 1890
B. 1895
C. 1898
D. 1899

145. What is an estimated annual individual and collective effective doses from diagnostic medical X-rays?
A. 0.22 mSv
B. 0.34 mSv
C. 0.5 mSv
D. 1 mSv

146. Which of the following deliverers the highest radiation dose to the patients?
A. Radiation therapy
B. Dental x-ray
C. Conventional radiography
D. Computed tomography

147. The treatment of cervical cancer involves external beam radiotherapy or radium or cesium in applicators to deliver high local doses of X-rays and gamma rays to the cervix uteri and adjacent organs in the abdomen and pelvic area.
A. True
B. False

148. Most of the information on second cancers following radiotherapy for cervical cancer comes from an international cohort study of approximately _____ women treated for cervical cancer.
A. 200
B. 2,000
C. 22,000
D. 200,000

149. More detailed dose-response investigations were carried out for which of the following after treatment for cervical cancer?
A. Leukemia
B. Breast cancer
C. Thyroid malignancies
D. Both A and B

150. The significant increase in the risk of which of the following cancer was observed among patients followed for 10 years or more after Hodgkin's Disease surgery?
A. respiratory
B. female genital
C. intrathoracic organs
D. all of the above

151. Radiotherapy increased the risk of _____ following platinum-based chemotherapy for ovarian cancer.
A. stroke
B. lung cancer
C. leukemia
D. none of the above

152. The treatment for childhood cancers, often a combination of both radiotherapy and chemotherapy, has shortened the life expectancy of children with cancer and decreased the chance of development of second cancers.
A. True
B. False

153. According to the research, the childhood cancers that were treated with radiation therapy, the risk for developing a second cancer in the 25 years after the diagnosis of the first cancer was as high as _____.
A. 5%
B. 10%
C. 12%
D. 20%

154. According to the study of childhood cancer survivors radiotherapy appeared to increase the risk of _____ for local doses greater than 15 Gy.
A. lung cancer
B. melanoma
C. cardiomyopathy
D. liver cancer

155. Studies of women treated for a first breast cancer have provided quantitative estimates of the risk of _____, at average doses of the order of 5-15 Gy.
A. thyroid cancer
B. bone cancer
C. ovarian cancer
D. lung cancer

156. In the past, radiation therapy has been used as treatment in different countries for which of the following conditions in children?
A. skin hemangioma
B. tinea capitis
C. enlarged thymus
D. All of the above

157. An elevated risk of _____ mortality was observed among those who received radiotherapy for peptic ulcer compared to those who did not.
A. pancreatic cancer
B. circulatory disease
C. thyroid cancer
D. none of the above

158. In the US, women received X-ray therapy to the ovaries and/or pituitary gland for refractory hormonal infertility and amenorrhea between 1925 and 1961.
A. True
B. False

159. _____ is currently the treatment of choice for hyperthyroidism, largely because no serious side effects are known.
A. Iodine-101
B. Iodine-300
C. Iodine-131
D. None of the above

160. Studies of patients treated with radiation (X-rays and gamma rays) for benign disease provide valuable information about the _____ of low-LET radiation.
A. atomic structure
B. carcinogenicity
C. chemical characteristics
D. none of the above

161. Between 1948 and 1960 nearly 20,000 children, primarily immigrants to Israel or children of immigrants from North Africa and the Middle East, were treated with radiation for ringworm of the scalp in Israel.
A. True
B. False

162. Based on the results of the Oxford survey and other studies of the effects of maternal irradiation, UNSCEAR reported a statistically significant leukemia risk (up to age15 years) and estimated a _____ increase in risk of childhood cancers (up to 15 years) at doses of 10-20 mGy of low LET radiation.
A. 20%
B. 30%
C. 40%
D. 50%

163. Studies of prenatal exposure to diagnostic X-rays have provided crucial information on the existence of a significantly increased risk of childhood cancer and leukemia following diagnostic doses of _____ in utero.
A. 5-10 mGy

B. 10-20 mGy
C. 25-50 mGy
D. 55-70 mGy

164. _____ is the leading cause of cancer mortality in industrialized countries, and its incidence is rising in many developing countries.
A. Lung cancer
B. Leukemia
C. Prostate cancer
D. None of the above

165. Which of the following is the primary cause of lung cancer?
A. Smoking
B. Ionizing radiation
C. Radon
D. Radiation therapy

166. _____ is the **most** diagnosed cancer and cause of cancer mortality among women in North America and Western Europe.
A. Ovarian cancer
B. Thyroid cancer
C. Breast cancer
D. Lung cancer

167. Ionizing radiation is well documented as a cause of breast cancer in women, especially when exposures occur in childhood and around puberty.
A. True
B. False

168. _____ is one of the less common forms of cancer and its incidence is relatively high before age 40.
A. Lung cancer
B. Thyroid cancer
C. Prostate cancer
D. None of the above

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169. A meta-analysis of _____ studies provide a risk estimate of thyroid cancer in relation to ^{131}I exposure in childhood.
A. leukemia
B. hepatitis
C. hyperthyroidism
D. none of the above

170. Leukemia is one of the less common malignancies, but substantial epidemiologic and experimental information exists on the leukemogenic effects of ionizing radiation.
A. True
B. False

171. Incidence rates for stomach cancer vary considerably throughout the world, with particularly high rates in _____.
A. China
B. Canada
C. South Africa
D. Japan

172. Many countries have seen decreases in stomach cancer incidence and mortality over the past 50 years or so, believed in large part to be due to healthier diets with decreased fruits and vegetables intakes and more salt.

A. True
B. False

173. _____ represent the **most** radiosensitive component of the cardiovascular system, with characteristic changes including detachment of endothelial cells and thrombosis.
A. Myocardium
B. Tricuspid valve
C. Capillaries
D. Left ventricle

174. Arterial changes resulting from radiation exposure depend on _____.
A. patient's age
B. cardiac output
C. vessel size
D. none of the above

175. Both animal and human studies have identified intimal thickening, lipid deposition, and adventitial fibroses of the vascular system following irradiation.
A. True
B. False

176. Excess heart disease mortality has been observed among women with _____ who were irradiated with cobalt-60.
A. ovarian cancer
B. breast cancer
C. cervical cancer
D. none of the above

Chapter 8
177. The risk of cancer among physicians and other persons exposed to ionizing radiation in the workplace has been a subject of study since _____.
A. the 1970s
B. the 1960s
C. the 1950s
D. the 1940s

178. Which of the following are occupationally exposed group to radiation?
A. Radiologists and Radiological Technologists
B. Nuclear medicine, Dentists and Hygienists
C. Nuclear and Radio-chemical industries
D. Airline crews and operators of nuclear-powered vessels
(E): All of the above

179. The type of ionizing radiation exposure varies among occupations, with differing contributions from photons, neutrons, and alpha- and beta-particles.
A. True
B. False

180. Which of the following situation is ideal for studies of risk estimation of radiation exposure?
A. the study design was adequate and no major bias could be identified
B. individual quantitative estimates of radiation dose to the organ of interest were available for study subjects
C. the details of the dose reconstruction or estimation approach were evaluated
D. a quantitative estimate of disease risk in relation to radiation dose—in the form of an excess relative risk (ERR) or excess absolute risk (EAR) per gray—was provided
(E): All of the above

181. Following are included in the report under nuclear industry EXCEPT:
A. Nuclear power

B. Uranium mining
C. The manufacture of nuclear weapons
D. Enrichment and reprocessing of nuclear fuel

182. Occupational radiation dose data constitute the most complete and detailed information currently available to researchers for studying the carcinogenic effects of low-dose exposure to ionizing radiation.
A. True
B. False

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183. Which of the following are main sources of radiation exposure for workers at uranium fuel production facilities?
A. external γ-ray exposure
B. internal depositions that deliver radiation doses (mainly from α-particles)
C. scattered x-rays from the tube
D. A and B only

184. _____ has been the primary outcome of interest in studies of workers in fuel enrichment and production facilities.
A. thyroid cancer
B. bone cancer
C. ovarian cancer
D. lung cancer

185. Which of the following countries were affected by the Chernobyl accident that resulted in widespread radioactive contamination?
A. Belarus
B. The Russian Federation
C. Ukraine
D. All of the above

186. Which of the following have been observed in most of the studies of liquidators from Belarus, Russia, and Ukraine as a result of Chernobyl accident?
A. increase in thyroid cancer
B. increase in leukemia
C. increase in lung cancer
D. both A and B

187. Studies of Chernobyl cleanup workers do not offer any important opportunities to evaluate the effects of protracted exposure in the low- to medium-dose range.
A. True
B. False

188. Airline pilots and flight attendants are exposed to which type of radiation during flights?
A. Alpha
B. Gamma
C. Cosmic
D. Beta

189. In 1999, the ICRP recommended that exposures to natural cosmic radiation should be considered occupational exposures for aircrews.
A. True
B. False

Chapter 9
190. Studies of environmental radiation exposure are composed of which of the following designs?
A. descriptive studies
B. case-control studies

C. cohort or followup studies
D. All of the above

191. The explosion at the Chernobyl Power Station Unit 4 in Ukraine on April 26, 1986, released large quantities of _____ into the atmosphere.
A. radionuclides
B. ionizing radiation
C. radon
D. All of the above

192. Iodine deficiency may also be an important modifier of the risk of radiation-induced thyroid cancer.
A. True
B. False

193. There is little conclusive evidence from epidemiologic studies of a link between parental preconception exposure to radiation and childhood leukemia or other cancers.
A. True
B. False

194. Which of the following is the major risk factor for lung cancer?
A. tobacco consumption
B. occupational exposure to a number of carcinogens
C. air pollution
D. All of the above

Chapter 10
195. For cancer sites other than breast, thyroid, and lung, the committee in the article recommends a weight of_____ for the estimate obtained using relative risk transport and a weight of _____of the estimate obtained using absolute risk transport with the weighting done on a logarithmic scale.
A. 0.1, 0.4
B. 0.7, 0.3
C. 0.6, 0.2
D. 0.8, 0.1

196. Atomic bomb survivor data for solid tumors combined provide statistical evidence of a radiation-associated excess at doses down to around _____.
A. 45 mSv
B. 55 mSv
C. 100 mSv
D. 200 mSv

197. Biologically based risk models are designed to describe the fundamental biological processes involved in the transformation of _____into malignant cancer cells.
A. somatic cells
B. germ cells
C. bone marrow cells
D. nerve cells

198. The committee concludes that the current scientific evidence is consistent with the hypothesis that there is a _____response relationship between exposure to ionizing radiation and the development of cancer in humans.
A. non-linear non-threshold dose-response
B. linear threshold dose-response
C. linear non-threshold dose-response
D. non-linear threshold dose-response