Chapter 39

1. In medicine, all of the following are basic types of radiation quantities *except:*

a. Radiation exposure

b. Absorbed dose

c. Dose equivalent

d. Effective dose

e. All of these are used in medicine

2. Which of the following is narrowly defined as the intensity of radiation incident upon

the surface of the body:

1. Dose
2. Exposure
3. Dose equivalent
4. Decay rate

3. Ionizing events in *air* are the basis for measuring:

a. air kerma

b. dose

c. exposure

d. A and C only

e. A, B and C

4. In devices that detect and measure radiation exposure, electrons liberated from atoms generate

a small electrical:

1. Charge
2. Current
3. Resistance
4. A or B
5. A or C

5. Which of the following is best defined as 6 billion billion ionizations in a cubic meter of

air:

1. 1 Coulomb per kilogram
2. 1 Kilovolt per cubic meter
3. 1 Becquerel
4. 1 Sievert

6. *Air kerma* has largely replaced the concept of exposure. The unit for air kerma is

the\_\_\_\_\_\_\_, which technically applies to absorbed energy.

1. Joule
2. Gray
3. Sievert
4. Becquerel

7*. Exposure area product (EAP*) expresses the effect of radiation exposure better than

exposure alone. To find the EAP, multiply exposure by:

1. The radiation weighting factor
2. The tissue weighting factor
3. The collimated area of exposed tissue
4. The collimated area of the x-ray beam

8. During a single \_\_\_\_\_\_\_\_\_\_ procedure, the total exposure to the patient is typically

distributed over different portions of the body.

1. Orthopedic surgery
2. Overhead radiography
3. Fluoroscopic
4. None of the above

9. For the best indication of the radiation received from a whole radiographic procedure

to a single patient, we add the EAPs of all exposed areas together to obtain the:

1. Surface Integral Exposure
2. Integral dose
3. Total Skin Exposure
4. DAP

10. A *dose* of radiation implies \_\_\_\_\_\_\_\_\_\_\_\_\_energy.

a. deposited

b. absorbed

c. internalized

d. all of the above

11. The Gray is defined as 1 \_\_\_\_\_\_\_\_\_ of energy deposited per kilogram of tissue”

a. Erg

b. Joule

c. Volt

d. Amp

e. Ohm

12. The Gray is unit for:

a. *kinetic energy released per mass*

b. dose equivalent

c. effective dose

d. dose area product

13. The distinction between 1 Gray of air kerma and 1 Gray of tissue kerma is:

a. The energy deposited

b. The mass absorbing the energy

d. The volume being irradiated

e. The type of radiation

14. One Gray delivered to a square meter of air will deliver one Gray to each \_\_\_\_\_

of tissue within the body:

1. Square meter
2. 10-cm cube
3. 10-mm cube
4. Kilogram

15. Body tissues are approximately \_\_\_\_\_ times denser than air.

a. 10

b. 100

c. 1000

d. 10,000

16. Precisely, 1 Gray of air kerma results in \_\_\_\_\_ of tissue dose.

a. Slightly less than 1 Gray

b. Slightly more than 1 Gray

c. Exactly 1 Gray

d. 10 Gray

17. For mammography, which of the following is estimated by multiplying

simulated measurements by dose factors that take into account breast thickness

and composition, as well as anode material, filtration and the kVp used:

1. Depth dose
2. Mean glandular dose
3. Average effective dose
4. Dose equivalent

18. Which of the following increase biological harm to the patient from radiation:

a. Increased dose

b. Larger areas of exposure

c. More exposures per procedure

d. All of these

e. None of these

19. *Dose Area Product (DAP)* is best defined as the:

a. Sum of individual effective doses for an entire population

b. Total energy absorbed by an individual for an entire procedure

c. Total energy absorbed by an individual for a single exposure

d. Biological harm level to a specific tissue or organ

20. The unit *Gray-Centimeters-Squared (Gy-cm2)* would apply to:

a. Dose

b. Integral dose

c. Dose area product

d. Collective effective dose

21. The dose in Gray:

a. Increases with x-ray field size

b. Is independent of collimated field size

c. Is spread out, and thus lessened, by increased field size

d. None of the above

22. Patient A receives a dose of 3 microgray (3 μGy). A 10 X 20 cm field was used for

the exposure. Patient B receives a dose of 2 microgray (2 μGy) using a 20 X 30

cm field. Compared to Patient A, Patient B receives:

1. 2/3 the biological harm
2. 1½ times the harm
3. 2 times the harm
4. 3 times the harm

23. The sum of doses from all exposures used in a particular radiographic procedure is

the:

1. Dose area product
2. Integral dose
3. Effective dose
4. Collective dose

24. Radiographic and fluoroscopic units can be equipped with \_\_\_\_\_ meters at the

collimator:

1. DE
2. ID
3. SIE
4. DAP

25. To indicate true biological harm, we use the unit abbreviated:

a. Gya

b. Gyt

c. Sv

d. Bq

26. To derive Sieverts from Gray, the dose is multiplied by:

a. 0.96

b. the field size area

c. the tissue weighting factor

d. the radiation weighting factor

27. How much harm is done by a 3 mGy dose of alpha particles?

a. 3 mGy

b. 3 mSv

c. 30 mSv

d. 60 mSv

28. One Gray of air kerma (exposure) causes approximately \_\_\_\_\_ of dose, which in

turn causes approximately \_\_\_\_\_\_ of dose equivalent.

1. 1 Gray; 1 Sievert
2. 1 Gray; 10 Sievert
3. 10 Gray; 10 Sievert
4. 10 Gray; 20 Sievert

29. To calculate the Effective Dose to the tissue of a specific organ, multiply:

a. Grays by Wt

b. Grays by Wr

c. Sieverts by Wt

d. Sieverts by Wr

30. The *occupational total body effective dose* for radiographers is generally assumed

to be \_\_\_\_\_\_\_ their monitor reading for a dosimeter worn outside any lead

apron:

1. equal to
2. one-half
3. one-fifth
4. one-tenth

31. Most occupational dose for radiographers comes from \_\_\_\_\_\_\_\_ procedures:

a. overhead

b. fluoroscopic

c. CT

d. orthopedic

32. Several personnel monitoring companies continue to us the older unit mrem

(millirem) for monthly reports: To convert mrem to μSv (microsieverts), simply:

1. divide by 2
2. multiply by 2
3. divide by 10
4. multiply by 10

33. For Radioactivity, the *Becquerel* is defined as \_\_\_\_\_\_\_ decay event(s) per second:

1. One
2. 1000
3. 1 million
4. 6 billion billion

34. *Man-Sieverts* is the unit for:

a. Effective dose

b. Integral dose

c. Integral surface exposure

d. Collective effective dose

1. The GSD is best described as the:
   1. dose required to double the mutation rate in a population
   2. dose required to cause skin erythema
   3. average dose to the gene pool of a population
   4. average bone marrow dose to a population
2. The active detecting component of a gas-filled ionization detector is the:
   1. chamber canister
   2. anode pin or plate
   3. scintillation crystal
   4. ionization region
3. The resolving time of a radiation detector is the time required:
   1. to read the meter
   2. to identify different types of radiation
   3. for the detector to respond to radiation
   4. to detect sequential ionizations
4. A personal monitoring device that emits its own light when *exposed to light* is a(n):
   1. OSLD (optically stimulated luminescence dosimeter
   2. TLD (thermoluminescent dosimeter)
   3. Film badge
   4. Pocket dosimeter
5. Which of the following personal monitoring devices can be read out *immediately* at any time by the radiographer:
   1. OSLD (optically stimulated luminescence dosimeter
   2. TLD (thermoluminescent dosimeter)
   3. Film badge
   4. Pocket dosimeter

40. What is the cumulative lifetime DEL for a 35-year old radiographer:

* 1. 350 mSv
  2. 5400 mSv
  3. 850 mSv
  4. 540 mSv

41. According to 1993 NCRP guidelines, all of the following are allowed a dose of 500

mSv per year EXCEPT:

* 1. Skin
  2. Bone marrow
  3. Gonads
  4. Eye lens

42. According to 1993 NCRP guidelines, the annual DEL for the hands is mSv:

a. 150

b. 300

c. 500

d. 750

1. According to 1993 NCRP guidelines, the **monthly** DEL for a developing fetus is

mSv:

* 1. 1
  2. 5
  3. 10
  4. 50
  5. 0.5

1. Filter materials in a radiation monitoring badge:
   1. emit visible light
   2. protect it from background radiation
   3. can be used to determine the type of radiation the radiographer was exposed to
   4. are not used
2. What is defined as the ability to precisely measure radiation intensity?
   1. recombination
   2. accuracy
   3. sensitivity
   4. continuous discharge
3. Which of the following is the **occupational** dose equivalent limit for a student under 18 years of age who is training in an oil field job where some radioactive materials are handled?
   1. 1 mSv per year
   2. 150 mSv per year
   3. 50 mSv per year
   4. 5 mSv per year
4. For which radiation detection device is a “glow-curve” obtained by annealing the

device at the end of the exposure period?

* 1. TLD
  2. Scintillation detector
  3. Pocket-dosimeter
  4. Geiger-Meuller tube

48. Which of the following would best be used as a field survey instrument for detecting

radiation?

a. proportional counter

b. ion chamber

c. scintillation detector

d. TLD

49. In a thermoluminescent dosimeter, the amount of light emitted when the crystal is heated is related to the by the crystal:

a. energy absorbed

b. mass absorbed

c. light absorbed

d. none of the above

50. The primary difference between a Geiger counter and an ion chamber is their:

a. basic method of radiation detection

b. basic electronic operating principle

c. method of display

d. operating voltage

51. What is the DEL for the general public per year?

a. 50 mSv

b. 12.5 mSv

c. 0.5 mSv

d. 1/10th of the occupational limit

52. Which of the following is included in the general public whole body dose limit?

a. radiation from a nearby mining operation

b. exposure from a chest radiograph

c. terrestrial radiation

d. internal radiation

e. radiation therapy treatments

53. Which of the following is **not** a whole body dose limiting organ?

a. gonads

b. GI tract

c. bone marrow

d. lens of the eye

54. Types of gas-filled ionization detectors for radiation detection include;

a. scintillation detectors

b. Geiger counters

c. thermoluminescent dosimeters

d. all of the above

e. none of the above

55. When making a measurement of radiation exposure in air, which of the following

would best be used?

1. film badge
2. TLD
3. Scintillation detector
4. Ionization chamber

56. The active component of a thermoluminescent dosimeter is a crystalline form of:

a. gadolinium oxysulfide

b. sodium iodide

c. lithium fluoride

d. calcium tungstate

57. The location of a lost radioactive source would be best accomplished by using a:

a. pocket dosimeter

b. ion-chamber survey meter

c. densitometer

d. scintillation counter

58. Which of the following personal monitors is most susceptible to chemical fumes,

heat, and moisture:

1. OSLD (optically stimulated luminescence dosimeter
2. TLD (thermoluminescent dosimeter)
3. Film badge
4. Pocket dosimeter

59. A Geiger counter can be damaged if the battery supplying it has too high a voltage,

causing it to operate in the region:

1. threshold
2. proportional
3. G-M plateau
4. Continuous discharge

60. The smallest detectable dose of a typical TLD personal monitor is about:

a. 1 microgray

b. 10 microgray

c. 50 microgray

d. 100 microgray

e. 1 milligray

61. Which of the following personal monitors can be restimulated numerous to confirm

the accuracy of an original reading, and can be worn up to one year:

* 1. OSLD (optically stimulated luminescence dosimeter
  2. TLD (thermoluminescent dosimeter)
  3. Film badge
  4. Pocket dosimeter

62. Which of the following is estimated to fall in a broad range between 500 and 2500

millisieverts:

a. the human doubling dose

b. the human LD 50/30

c. the GSD

d. the threshold dose for cataracts

63. Dosimetry instruments designed for radiation can operate in which mode?

a. pulse mode

b. rate mode

c. integrate mode

d. all of the above

e. none of the above

64. For a gas ionization type of device, which of the following effects occurs when the

supplied voltage is too low for the device to detect radiation:

1. Recombination
2. Simple ionization
3. Cascade effect
4. Saturation

65. Of the following regions in the voltage-dependence curve for gas ionization devices,

which one forms a “plateau” indicating that the device would still be accurate if

the supplied voltage (from batteries, for example) were a little low or a little high:

1. Recombination
2. Simple ionization
3. Proportional region
4. Continuous discharge

66. Which of the following operates on the basis of the saturation effect:

a. Geiger counter

b. Proportional counter

c. Ion chamber

d. Scintillation counter

67. A Geiger counter cannot be used to measure x-ray machine output because it:

a. is based on gas ionization

b. is too sensitive

c. is not sensitive enough

d. cannot detect x-rays, only beta and alpha particles