1. A cobalt 60 Machine has an activity of 10,135 curies and decays by the emission of beta minus particles. If the emission of these electrons is considered to be an electric current what is its magnitude (electron charge =1.6x 10^{-19} Coulomb)?

A. 1x 10^{-6} Amp

B. 10x 10^{-6} Amp

C. 6x 10^{-6} Amp

D. 60x 10^{-6} Amp

2. How many electrons per gram are there for the hydrogen atom (Avogadro's Number= 6.0228x 10^{23})

A. 3.0x 10^{23}

B. 6.0x 10^{23}

C. 9.0x 10^{23}

D. 1.0x 10^{23}

3. An iridium 192 source has an activity of 3.7 x 10^9 Bq. What is the activity in mCi?

A. 100

B.0.1

C.10

D.1000

4. Which of the following is never emitted during radioactive decay?

A. Alpha Particle

B. Proton

C. Positron

D. Gamma Ray

5. Of the following radioisotope which one has the shortest half life?

A. Ra^{226}

B. Pd^{103}

c. Au^{198}

D. Rn^{222}

6. Which type of nuclear radiation has shortest range in tissues?

A. Alpha particles

B. Beta particles

C. positrons

D. Neutinos

7. What kind of radioactive equilibrium can occur when a very long lived radionuclide decays to avery shortest one.

A. Thermal

B. Secular

C. Transient

D. Non-stable

8. How many mCi of radioactive isotope ($t_{1/2}$=2.7 days) are required so that the samples activity will be 10mCi 24 hours later?

A. 11.29

B. 15.89

C.12.93

D.47.34

9. The ratio of compton interaction in one gram of hydrogen to one gram of water is about

A. 0.5

B.1.0

C.2.0

D. Dependent of Photon energy.

10. What is the LET of the 9 MeV electron in soft tissue?

A. 1 MeV/cm

B. 2 MeV/cm

C. 5 MeV/cm

D. 10 MeV/cm

11. In a diagnostic radiograph the process mostly responsible for differential attenuation is

A. Coherent scatter

B. Compton Interaction

C. Photoelectric Interaction

D. Pair Production

12. Which of the following is true for low level radioactive waste , such as tubing and swabs contaminated with ^{99m}Tc ?

A. They can never be thrown away , Since some activity always remains

B. They can be thrown away immediately , Since amount of activity is generally harmless

C. they can only be disposed by a commercial radioactive waste

D. They can be stored until reaching background levels then disposed of with other medical trash

13. In ultrasound a 4 MHz transducer has a useful range of 10cm. What is the maximum pulse repetition frequency of this transducer?

A. 7.7 kHz

B.10KHz

C.40KHz

D.154KHz

14. The spatial resolution with MRI is about the same as that obtained with

A. SPECT

B.PET

C.CT

D. Mammography

15. For patients studies , CT image quality can be improved by all factors listed below except

A. Short scan times

B. optimized reconstruction algorithms

C. smaller pixel size

D. lower kVps

16. Two materials used to calibrate the CT number scale of CT scanner are:

A. Tissue and Bone

B. Tissue and Water

C. Water and Air

D. air and acrylic

17. An ultrasound transducer which utilizes a series of elements that transmit sequential sound waves in order to form a rectangular image is called

A. Annual array

B. Phased array

C. Linear array

D. Sector Scanner

18. In nuclear medicine studies , the critical organ dose is usually limited to less than _____cGy.

A. 1

B. 2

C. 5

D. 10

19. Factors which complicates SPECT studies include all of the following item except.

A. Attenuation correction

B. Detector non uniformities

C. positron range

D. Compton scatter photons.

20. The radiation dose equivalent to fetus of a pregnant patient is not considered to pose of a significant risk until it exceeds _____mSv

A. 1 to 5

B. 5 to 10

C. 25 to 50

D. 50 to 100

21. A cobalt source has a certificate stating that the exposure rate at 1 meter is 120R/min on Jan 15. If the source is installed on June 15 , the dose rate to a small mass of tissue in air at 80 cm on that date is _____cGy / min

A. 151

B.85

C. 70

D.170

22. I-125 seeds are ordered for a prostate implant the procedure is then delayed for one week , but the same seed are implanted. The change in actual dose delivered to the prescription isodose is

A.16%

B.8%

C.4%

D.2.4%

23. A cesium -137 source had an activity of 30mg Ra eq.in September 198. What is the activity in mCi in march 1994 (The exposure rate constant of Cs-137 is 3.32 $R.cm^2/mCi.hr$)

A.27

B.59

C.67

D.74

24. The exposure rate 4 meters from a patient containing 60mg -Ra eq. . filtered with 0.5 mm Pt is about _____mR/hr. Consider the applicator to a point source and that the patient absorbs about 30% of radiation.

A.1

B.2

C.3

D.4.5

25. The average life of radioisotope is:

A. Used to calculate the total dose delivered by a permanent seed implant

B. Equal to 1.44/half life

C. Used to calculate the dose rate mid-way through a temporary insertion

D. Also called the decay constant.

26. Patterson-Parker tables can be used to calculate treatment times for all of the following except:

 A .Iridium 192 breast implant with equal activity seeds in lines 1 cm apart

B. A needle implant without crossed ends

C. an implant with equal activity per cm around the periphery

D. A radium tube mould

27. A radium source _____ with its daughters

A. Is in transient equilibrium

B.Is in secular equilibrium

C. never achieves equilibrium

D. Always achieves equilibrium

28. The equivalent square of a 9x17 cm field is

A.1.4

B.6.8

C.10

D.11.8

29. The penumbra of Cobalt 60 decreases as

A. SSD increases

B. Source diameter decreases

C. Source to collimator distance decreases

D. Field width increases

30. The position of secondary collimators on a LINAC is important when treating with an electron applicator because it can affect

A. Output and flatness

B. output only

C. Selection of correct scattering foil

D. Ability to attach applicator

31. The half-life of iodine -125 is 60 days. In 6 months, the activity will be _____ its original value

A. In transient equilibrium with

B.50% of

C.1/8th of

D.5% of

32. The approximate dose delivered by a single Ir-192 seed of activity 0.5mg Ra equivalent in 24 hrs to tissue 2 cm from the seed is

A. 384cGy

B.96cGy

C.48cGy

D.24cGy

33. The following are the advantages of Cs-137 sources over radium sources , except

A. lower maximum photon energy

B. smaller HVL in Pb

C. shorter half life

D. less exposure to personnel.

34. The X ray beam spectrum of a 10MV LINAC is characterized by

A. Maximum photon energy of 10MV , average about 3MV

B. All photon have energy of about 10MV

C. All photon have energy of about 3MV

D. Equal number of photons at all energies up to 10MV

35. Machine output chambers are not used in Cobalt-60 units because

A. they are only used for electrons

B. Cobalt 60 has predictable output

C. temperature pressure corrections cannot be made on a cobalt 60 unit

D. they will perturb the Cobalt 60 beam

36. A buildup cap for an ionization chamber

A. is used to protect the chamber from mechanical damage

B. should be of high Z material

C. prevents stem leakage

D. Must be thick enough to provide along with chamber wall, electronic equilibrium.

37. A cell of mass 10^{-7} absorbs 10^{-10} J of energy during irradiation. What dose did it receive?

A. 0.01cGy

B.1.0 cGy

C.10 cGy

D.100 cGy

38. If a diagnostic X-ray beam has a first HVL of 3mm aluminium , then adding 6mm of Al to the filtration would decrease the intensity to:

A. 50%

B. somewhat more than 25%

C. somewhat less than 25%

D. 25%

39. A photon has a frequency of 3MHz . Its wavelength is

A.1cm

B.3cm

C.9m

D.100m

40. CT or Hounsfield number is linearly related to

A. Mass density

B. Electron density

C. Linear attenuation Coefficient

D. Mass attenuation Coefficient

KEY

1. D

2.B

3.A

4.B

5.C

6.A

7.B

8.C

9.C

10.B

11.C

12.D

13.A

14.C

15.D

16.C

17.C

18.C

19.C

20.D

21.D

22.B

23.C

24.B

25.A

26.A

27.B

28.D.

29.B

30.A

31.C

32.D

33.B

34.A

35.B

36.D

37.D

38.B

39. D

40.C