1. Sketch and label an X-ray Tube:
2. The symbol R means:
   1. Rem
   2. Rad
   3. Roentgen
   4. Radiation
3. The Roentgen (R) exposure is measured in:
   1. Tissue
   2. Water
   3. A lab
   4. Air
4. The symbol mR means:
   1. Milliroentgen
   2. Microroentgen
   3. Megaroentgen
   4. Millirem
5. Activity of radioactive material is measured in
   1. Curies
   2. Roentgens
   3. Sieverts
   4. grays
6. One Roentgen or 1R is equal to:
   1. 100 milliroentgen
   2. 1000 milliroentgen
   3. 0.001 milliroentgen
   4. 1 milliroentgen
7. Becquerels and Curies are units of measurement of:
   1. Physical size of the source
   2. Gray per hour
   3. Decay rate
   4. Roentgen per hour
8. Atoms that have excess energy and are unstable are known as:
   1. Radioactive
   2. Radioactivity
   3. Balanced
   4. Weighted
9. The area known as the center of an atom is called the:
   1. Electron
   2. Nucleus
   3. Proton
   4. Neutron
10. The process that results in the removal of orbital electrons from atoms resulting in the formation of ion pairs is called:
    1. Excitation
    2. Radioactivity
    3. Decay
    4. Ionization
11. After 6 half-value layers, what percentage of radiation would be received?
    1. 50%
    2. 25%
    3. 8%
    4. 1.6%
12. If a radiographer has 60 mR at the surface of the exposure device, what would the reading be after 2 half-lives?
    1. 15 mR
    2. 40 mR
    3. 80 mR
    4. 10 mR
13. A sealed source emits what?
    1. Alpha particles
    2. Beta particles
    3. X-rays
    4. Gamma rays
14. A radiographer and assistant are standing in a 2 mR/hr field. What would the assistant’s total dose be after 4 hours?
    1. 2.0 mR
    2. 4.0 mR
    3. 6.0 mR
    4. 8.0 mR
15. You have 24 exposures to make. Your shot time is 5 minutes per exposure and your showing 30 mR/hr. What will be your total dose at the end of the shift?
    1. 30 mR
    2. 60 mR
    3. 120 mR
    4. 240 mR
16. Which of the following are used primarily in radiography?
    1. Gamma sources
    2. Radio Waves
    3. X-rays
    4. Microwaves
    5. Both A and C
17. Radiation is defined as:
    1. Ionized Beta Alpha particles
    2. Energy in transit, either as particles or electromagnetic waves
    3. Heat and light emitting only from gamma sources like uranium or the sun
    4. Energy that does not burn or ionize
18. An Ion:
    1. An atom or part of an atom with a + or a – charge
    2. A long, long time
    3. Is not harmful to humans
    4. None of the above
19. Only Gamma radiation can ionize matter.
    1. True
    2. False
20. Which of the following are examples of “non-ionizing” radiation?
    1. Near UV and radio waves
    2. Visible light and Microwaves
    3. Infrared
    4. All of the above
21. Which of the following are two types of electromagnetic radiation used for industrial radiography?
    1. X-rays and Microwaves
    2. Gamma and X-rays
    3. Gamma and Radio waves
    4. Infrared and UV
22. The term used to describe the decay of an isotope to one half of the original value is:
    1. Radioactive decay
    2. Half value layer
    3. Time, Distance, Shielding
    4. Half-Life
23. The main difference between Gamma radiation and X-ray radiation is:
    1. Speed of radiation travel
    2. The source of radiation
    3. Penetrating power
    4. X-ray is not very dangerous
24. What is the safe dosage rate for the public?
    1. 2 R/hr
    2. 20 mr/hr
    3. 2 lamda per M
    4. 2 mr/hr
25. Write out the HVL Formula and identify what the variables stand for:
26. If the radiation intensity of Co60 at a certain point is 24R/hr, how many H.V.L are required to reduce the intensity to 5 R/hr?
    1. How much lead (thickness) will be required to attain 5 R/hr in the calculation above?
    2. How much concrete (thickness) will be required to attain 5 R/hr in the calculation above?
27. If the radiation intensity of Co60 at a certain point is 112R/hr, how many H.V.L are required to reduce the intensity to 5 R/hr?
    1. How much lead (thickness) will be required to attain 5 R/hr in the calculation above?
    2. How much concrete (thickness) will be required to attain 5 R/hr in the calculation above?
28. If the radiation intensity of Ir 192 at a certain point is 24R/hr, how many H.V.L are required to reduce the intensity to 5 R/hr?
    1. How much lead (thickness) will be required to attain 5 R/hr in the calculation above?
    2. How much concrete (thickness) will be required to attain 5 R/hr in the calculation above?
29. If the radiation intensity of Ir 192 at a certain point is 67R/hr, how many H.V.L are required to reduce the intensity to 5 R/hr?
    1. How much lead (thickness) will be required to attain 5 R/hr in the calculation above?
    2. How much concrete (thickness) will be required to attain 5 R/hr in the calculation above?
30. Write the formula for solving for the New Intensity (I2):
31. We have 50 R/hr @ 12”, what is our intensity at 10 feet?
    1. Does the difference in units matter? Y or N?
    2. Write out the equation and Solve for our new intensity.
32. We have 67 R/hr @ 1M, what is our intensity at 75 feet?
    1. Does the difference in units matter? Y or N?
    2. Write out the equation and Solve for our new intensity.
33. Write the formula to solve for a New Distance (D2):
34. We know that 1 ci of iridium 192 emits 5.2 R/hr @ 1ft. So a 100 ci source of IR 192 would emit how many R/hr @ 1ft?
35. Using a 100 ci source of IR 192 at 12”, Calculate the distance (D2) to the “safe for public dosage.”
    1. What is that dosage rate?
    2. **Show your work.**
36. **We have a 100 ci source of CO 60:**
    1. How many R/hr do we have at 1 foot?
    2. Calculate the distance (D2) to the safe working dosage for a radiographer.
    3. Calculate the distance (D2) to the safe for public dosage.

**BONUS Questions:**

1. How many R/hr are emitted at 1 foot from the 100 ci source of CO-60?
2. Calculate the number of HVL’s needed to achieve a safe working dosage.
3. And then calculate the thickness of lead required to achieve the safe working dosage above