1. Sketch and label an X-ray Tube:
2. What does the following acronym represent? A L A R A
	1. As Low As Reasonably Achievable
	2. As Long As Radiation Absconds
	3. Laura’s Radiation Principles
	4. Achievable Low Radiation Absorption
3. Which of the following type of nuclear reactions is used to create isotopes for industrial radiography?
	1. Nuclear Fission
	2. Nuclear Fusion
4. Which of the following nuclear reactions is occurring on the sun?
	1. Nuclear Fission
	2. Nuclear Fusion
5. The Roentgen (R) exposure is measured in:
	1. Tissue
	2. Water
	3. A lab
	4. Air
6. The unit that compares the biological effectiveness of the different types of radiation is the:
	1. REM
	2. RAD
	3. Roentgen
	4. QF
7. The abbreviation RAD stands for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	1. Radiation Absorbed Dose
	2. Radical Man
	3. Outrageousness
	4. Roentgen Absorbed Dose
8. The abbreviation REM stands for:
	1. Radiation Equivalent Mammal
	2. Relative Equivalent Man
	3. Roentgen Equivalent Man
	4. Radical Equivalent Man
9. QF x RAD = what?
	1. Radiation Equivalent Mammal
	2. Roentgen Equivalent Man
	3. Relative Equivalent Man
	4. Radical Equivalent Man
10. An exposure of 5R of alpha particles is equal to:
	1. 5 REM
	2. 50 REM
	3. 20 REM
	4. 100 REM
11. The whole body radiation dose must normally be limited to a dose of:
	1. 1 ¼ rems per calendar quarter.
	2. 18 ¾ rems per calendar quarter.
	3. 7 ½ rems per calendar year.
	4. 5 rems per calendar year.
12. The earliest indications of radiation damage may be detected in the:
	1. Nerve cells.
	2. Skin cells.
	3. Bone cells.
	4. Blood cells.
13. The physical effects of radiation on the body of an individual receiving the radiation are called:
	1. Somatic effects
	2. Latent effects.
	3. Genetic effects.
	4. Radiosensitive effects.
14. The radiation effects which can be passed on to the offspring or to a later generation of a person receiving radiation are called:
	1. Future effects.
	2. Genetic effects.
	3. Somatic effects.
	4. Radiosensitive effects.
15. In relation to radiation effects, MLD stands for:
	1. Maximum Lethal Dose
	2. Median Lethal Dose
	3. Minimum Legal Dose
	4. Maximum Legal Dose
16. The MLD for humans is the radiation dose:
	1. That causes the first death.
	2. That causes slight, temporary blood changes.
	3. That is considered lethal to all persons exposed.
	4. That causes 50% of those exposed to die.
17. The MLD for humans is approximately\_\_\_\_\_\_\_\_\_\_\_\_\_ rems whole body exposure within 24 hour period.
	1. 250 – 350 rem.
	2. 400 – 500 rem.
	3. 750 – 1,000 rem.
	4. 1000 – 1,250 rem.
18. Devices attached to the clothing of people working in radiation areas for measurement of radiation are called:
	1. Survey instruments.
	2. G-M counters
	3. Personnel monitoring devices.
	4. Portable rate meters.
19. HVL stand for:
	1. Half Value Layer
	2. Half Value Luminescence
	3. Half Vetted Layer
	4. High Value Layer
20. Materials used in shielding radiation are most effective when they:
	1. Have a small number of electrons in their atoms.
	2. Are dense materials.
	3. Shield half of the radiation.
	4. Are light weight and portable
21. When a body tissue cell is damaged by radiation:
	1. The cell may lose its ability to reproduce.
	2. The cell may die.
	3. Damage is caused by knocking an electron out of the orbit of its parent atom.
	4. All of the above
22. Atoms that have excess energy and are unstable are known as:
	1. Radioactive
	2. Radioactivity
	3. Balanced
	4. Weighted
23. 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
24. After 6 half-value layers, what percentage of radiation would be received?
	1. 50%
	2. 25%
	3. 8%
	4. 1.6%
25. 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
26. A sealed source emits what?
	1. Alpha particles
	2. Beta particles
	3. X-rays
	4. Gamma rays
27. 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
28. 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
29. 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
30. 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
31. Only Gamma radiation can ionize matter.
	1. True
	2. False
32. 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
33. 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
34. 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
35. 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
36. 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

To solve for a distance use the following formula: $D\_{2}=\sqrt{\frac{I\_{1}xD\_{1}^{2}}{I\_{2}}} $

**D** = Distance **I** = Intensity in Röntgens

To solve for Intensity use the following formula: $I\_{2}= \frac{I\_{1} x D\_{1}^{2}}{D\_{2}^{2}}$ $ $

Iridium 192: 0.48 R/hr/ci @ 1M or 5.2 R/hr/ci @ 1’

Cobalt 60: 1.30 R/hr/ci @ 1M or 14 R/hr/ci @ 1’

1 R = 1000 mr 1M = 3.28 ‘ = 39.37” 1” = 2.54 cm, 1’ = 30.48 cm

Half Value Layer: $HVL=\frac{LOG [\frac{I\_{o}}{I\_{d}}]}{LOG2}$

 Io = Original Intensity

 Id = Desired Intensity

**Math Problems: You will receive up to ? points for each of the following math problems based on the following criteria:**

* (1) State what you’re solving for (possibly more than 1 variable is being solved for)
* (1) Write out the initial equation with the variables included
* (3) The final answer(s) including units.
* No Units = Wrong Answer
* Wrong Units = Wrong Answer
1. We have 25 R/hr @ 12”, what is our intensity at 10 feet in mr/hr?
	1. What are you solving for?
	2. Answer:
2. Using a 75 ci source of IR 192 at 12”, Calculate the distance (D2) to the “safe for public dosage.”
	1. What are you solving for?
	2. Answer:
3. We have an IR-192 source with an original strength of 50 ci received about 150 Days ago.
	1. What is the ½ life of IR-192?
	2. How many ½ lives did we decay to?
	3. What is the current strength of this source? (In Curies)
	4. What is the output of the source above at 1-foot distance?
	5. What is the calculated radiation level at 1 meter?
4. If the H.V.L of lead for Co-60 is 0.49 inches, what thickness of lead would be required to reduce 600 mr/hr of radiation to under 2 mr/hr?
	1. Solving for?
	2. Answer:
5. If the H.V.L of concrete for Co-60 is 2.6 inches, what thickness of concrete would be required to reduce 600 mr/hr of radiation to under 2 mr/hr?
	1. Solving for?
	2. Answer: