

## BASIC RADIOLOGICAL PHYSICS COURSE

CLASS GROUP: \_\_\_\_\_  
(Radiation Therapy, Radiation Oncology Resident, Post Doctoral..)

YEAR: \_\_\_\_\_  
(2004, 2005 ...)

**Objective:**

After completing this Study Guide #5, the students should be able to understand (1) operations of radiation instruments, (2) personnel monitoring, (3) minimizing radiation exposure, (4) dealing with contamination, and (4) radiation emergencies.

**Study Guide #5:** Health Protection I (Part 2 of 2)

Read Sections: Foundation of Radiological Physics (C B Saw)  
Chapter 13 – Health Physics I  
**Sections 13.5 to 13.12**

Suggested Reference: Faiz Khan's text – Chapter 16

Assignments: Answer all questions as directed in this handout

Clinical Rotation Identify two safety features installed on an HDR suite  
Assignment:

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### Study Guide

- 13.1 In your own words, define the following terms:
- |                         |                               |
|-------------------------|-------------------------------|
|                         | (l) saturation in ion chamber |
| (m) personal monitoring | (n) areal monitoring          |
| (o) HVL                 | (p) TVL                       |
- 13.14 Identify the bias voltage range for each type of radiation detectors: (a) diodes, (b) ionization chambers, and (c) Geiger-Muller counters.
- 13.15 Explain the principle of the operation of a Geiger-Muller counter. Discuss its advantages and disadvantages as a survey instrument.
- 13.16 Your GM counter was reading 1.5 mR/h with a setting on the x0.1 scale. What is your measured exposure rate?
- 13.17 What is the highest scale on your GM counter?
- 13.18 Explain why a liquid scintillation counter is appropriate for the detection of tritium.

- 13.19 List three types of personnel radiation monitoring devices.
- 13.20 What criteria should be used to determine whether a person working in a controlled area should wear a radiation badge?
- 13.21 Explain the operation of each detection system: (a) film badge, (b) TLD badge, and (c) pocket dosimeter.
- 13.22 List the advantages and disadvantages of each of the following radiation monitoring systems: (a) film badge, (b) TLD badge, and (c) pocket dosimeter.
- 13.23 Discuss why a body badge should be worn under an apron. At which anatomical location should you wear your badge?
- 13.24 Under what circumstances should an individual wear two badges?
- 13.25 Determine whether wearing a 0.5 mm Pb equivalent apron is an effective means of radiation protection under the following conditions:  
(a) an iridium-192 implant                      (b) an iodine-125 implant  
(c) a diagnostic x-ray procedure              (d) a technetium-99 patient  
(e) positron scanning procedure
- 13.26 One TVL is equivalent to how many HVLs?
- 13.27 Explain why it is a good practice not to use bare hands to hold radioactive sources?

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**Problems**

- 13.6 After a film has been exposed to 150 cGy and processed, the optical density was found to be 2.0. What is the transmitted intensity compared with the original intensity as measured using a densitometer?
- 13.7 A student watches a brachytherapy procedure in a patient's room. If the student is 2 m away and receives 6 mR/h, what would be the exposure rate if the student moves to a position 3 m away from the patient?
- 13.8 A radiation oncology resident responded to the concerns of a brachytherapy patient. If it took 20 minutes to satisfactorily answer the patient's concerns, what was the exposure to the resident if the exposure rate was 15 mR/h?
- 13.9 The probability that a monoenergetic photon beam will be attenuated by a 2 mm thick lead is 75%. What is the HVL of this beam?
- 13.10 A line ribbon consisting of 10 iridium-192 seeds was dropped during a procedure. What was the exposure rate in mR/h at the patient's room door 4 m away? Assume that the activity of each seed was 1 mCi and the exposure rate constant for Ir-192 is 4.6 R-cm<sup>2</sup>/mCi-h. Is this amount of activity detectable at this location?

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**Multiple Choice Questions**

Choose one correct answer.

- 13.7 Which of the following is NOT TRUE of the film badge?
- a) It serves as a permanent record.
  - b) It is cheaper than TLDs.
  - c) The low dose response is better than TLDs.
  - d) It is susceptible to water.
  - e) none of the above.
- 13.8 The amplitude of the signal from a proportional counter
- a) is the same for all types of radiation.
  - b) is proportional to the number of ions produced by a charged particle traversing the chamber.
  - c) will be greater for an electron than for an alpha particle.
  - d) is proportional to the exposure rate.
  - e) none of the above.
- 13.9 Which of the following is not the cardinal principle of minimizing radiation exposure?
- a) Time
  - b) Distance
  - c) Shielding
  - d) Education
  - e) none of the above
- 13.10 The primary purpose of the filter in a film badge is
- a) to absorb scattered radiation.
  - b) to secure the optical density range.
  - c) to allow the measurement of dose over a range of energies.
  - d) to change the slope of the H&D curve.
  - e) none of the above.

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