

Continuing Education Assessment Examination

In this age of major and enhanced bioscientific efforts, concomitant alterations of allied health education and practice are occurring. In order for alterations in these important areas to be meaningful, goals, priorities, and components of competency must be established within the overall framework. Nuclear medicine technology is no exception to the continuum of medical education and information.

Scientific information, basic and clinical, has become increasingly more specialized. With such a remarkable level of growth and sophistication, individual comprehension of its complexity and sheer volume are nearly impossible. As a result, the emphasis has shifted toward specialty education and training. Some professional organizations have assisted in "filling the gaps" by presenting and conducting continuing educational activities.

While the goal of educational programs in nuclear medicine technology is to prepare the best qualified students to the allied health field, two important factors must be identified: (A) not all nuclear medicine technologists have completed an approved program; and (B) education must

continue after the formal didactic and clinical experiences which are structured during a program or on-the-job training. Therefore, there can exist the necessity of some individual technologists requiring continued education for basic information, others requiring continued education for completion of certification examinations, and certainly everyone for increasing and replenishing his professional competency.

To these ends, the Technologist Section, through collaborative efforts of the Publication and Continuing Education Committees, is developing an ongoing, self-assessment program for all nuclear medicine technologists in the *JNMT*.

Prior to implementing such a program, it will be necessary to obtain some idea of the input that can be expected from the membership. Therefore, the committees have drawn up the following examination for two purposes: (A) to assess the need for continuing education in nuclear medicine and (B) to explore the possibility of continuing future programs based on the total number of responses to the examination. An answer sheet for this exam is provided on p. 19.

- In pyrogen testing normally done on radiopharmaceuticals, rabbits are the animals of choice. After injection of the product to be evaluated, which of the following parameters is monitored?
 - blood samples
 - respiratory function
 - pulse rate
 - temperature
- A sterile product is a pyrogen-free product.
 - this statement is true
 - this statement is false
 - it depends on the types of pyrogens present
 - it depends on the types of radiopharmaceuticals being tested
- Considering the ^{99m}Tc , ^{87m}Sr , and ^{113m}In generator systems, on which of the following criteria do they differ?
 - sterility of the eluates
 - possession of ion exchange columns
 - the eluates of each can be immediately injected
 - none of the above
- Both the $^{99}\text{Mo}/^{99m}\text{Tc}$ generator and the $^{87}\text{Y}/^{87m}\text{Sr}$ generator systems are generally thought to employ which of the following types of equilibrium?
 - none
 - secular
 - transient
 - parallel
- Which of the following mechanisms explains the localization of ^{99m}Tc -sulfur colloid in the liver?
 - active transport by the polygonal cells
 - phagocytosis by the Kupffer cells
 - phagocytosis by the polygonal cells
 - this mechanism has never been completely described
- Iodinated MAA is localized in the lungs by which of the following mechanisms?
 - capillary blockade
 - simple diffusion
 - active transport
 - gravitational equilibrium
- In the hot lab, ^{99m}Tc is usually eluted from the alumina column with a solution of:
 - NaHCO_3
 - NaCl
 - KCl
 - HCl
- Millipore filters can be used in the hot lab to render certain radiopharmaceuticals free of:
 - pyrogens
 - bacteria
 - viruses
 - none of the above
- One circuit element found in most laboratory scalers is the:
 - binary flip-flop
 - double discriminator
 - mechanical register
 - Schmidt trigger
- The crystal efficiency of a scintillation camera is greatest when interacting with photons from which of the following radionuclides?
 - ^{198}Au
 - ^{113m}In
 - ^{131}I
 - ^{99m}Tc
- Given a 75-mCi source of ^{54}Mn , which has a gamma intensity of 362 mR/hr at 1 meter, what is the intensity at 2.5 cm?
 - 580 R/hr
 - 1440 mR/hr
 - 2720 mR/hr
 - 144 R/hr
- Based on the characteristics of $\text{NaI}(\text{Tl})$ crystals, certain precautions are necessary to insure longevity of the crystal in a scanner system. One should avoid which of the following situations?

- a. physical stress to any part of the crystal
 - b. sudden changes in the ambient temperature
 - c. disruption of the normal hermetic seal
 - d. all of the above
13. An animal is given an intravenous dose of a radioactive substance. The *calculated* total dose had an activity of 20,000 cpm. A postinjection sample of blood was found to have an activity of 300 cpm/ml. The detection equipment was found to have an efficiency of 40%. Which of the following is the percent of the injected dose found per milliliter of postinjection blood?
 - a. 1.5%
 - b. 2.3%
 - c. 3.7%
 - d. 4.8%
 14. The Bragg-Gray curve describes the specific ionizing effects of incident particles on matter. An alpha particle is incident on matter. What is the relationship of the number of ion pairs produced per unit length of this alpha particle?
 - a. the specific ionization will be uniform over all increments of the alpha particle's path
 - b. more ion pairs are produced near the end of the path because the alpha particle's velocity has been decreased and greater time is allowed for collision or interaction
 - c. the alpha particle's velocity is decreasing after impact and therefore at the end of its path fewer ion pairs are formed
 - d. more ion pairs will be initially produced because of the alpha particle's greater energy on impact than at the end of its path
 15. On which of the following factors is backscattering *not* dependent?
 - a. atomic number of backing material
 - b. thickness of backing material
 - c. energy of the incident particles
 - d. the distance from source to detector
 16. Repetitive measurements of the activity of a long-lived radionuclide will yield different values on each measurement. Assuming no fluctuation in equipment efficiency, which of the following can account for these different values?
 - a. temperature and chemical changes in the sample
 - b. the randomness of radioactive decay
 - c. variations in the decay energies
 - d. none of these explains the phenomena
 17. Gamma radiation is a form of electromagnetic energy. In what characteristic do gamma rays differ from x-rays, which are another form of electromagnetic energy?
 - a. wavelength
 - b. biologic effectiveness
 - c. frequency
 - d. origin
 18. In obtaining quantitative data, errors are possible and must be accounted for. Assume that you are using a well-type scintillation detector to obtain the quantitative information. Which of the following potential sources of error will be minimized by the use of such a detector system?
 - a. equipment malfunction
 - b. geometric factors
 - c. backscattering
 - d. randomness of radioactive decay
 19. If you stood in a 100 mR/hr radiation field (gamma) for 1½ hr, you would receive an exposure of:
 - a. 150 mR
 - b. 300 mrays
 - c. 137.5 mm
 - d. 150 mrems
 20. Strontium-87m is considered clinically useful because:
 - a. it is a beta emitter
 - b. it has a long effective half-life
 - c. it is a bone seeker
 - d. all of the above
 21. A patient is referred to the nuclear medicine clinic with a suspected stroke. On what *primary* factor is visualization of the lesion dependent?
 - a. time after onset of symptoms
 - b. age of patient
 - c. location of cranial lesion
 - d. none of the above
 22. A curie indicates that a radioactive nuclide is disintegrating at a rate of 3.7×10^{10} dps. A microcurie indicates what disintegration rate?
 - a. 3.7×10^4 dps
 - b. 3.7×10^7 dps
 - c. 3.7 dps
 - d. none of the above
 23. The relative biologic effectiveness for gamma radiation is:
 - a. 2
 - b. 1
 - c. 10–20
 - d. 2–5
 24. A vial containing 10 mCi of ^{14}C is located 2 ft from where you are working. How much lead is needed to reduce the radiation level in your area to less than 2 mR/hr?
 - a. 1 mm
 - b. 1.5 mm
 - c. 1 cm
 - d. none of the above
 25. The detection of radioactively "tagged" compounds in cells, organs and/or body fluids is based on:
 - a. physically measurable properties of the compound
 - b. chemically measurable properties of the compound
 - c. the release of electromagnetic or particulate radiations
 - d. the preferential uptake of the radioactive tag in the cells or body
 26. Autoradiography is a:
 - a. photograph of an organ section
 - b. radiograph produced by contact between a slice of an organ which has absorbed a radioisotope and a photographic plate
 - c. radiograph by the use of roentgen rays
 - d. none of the above
 27. Which type of cranial lesion concentrates $^{99\text{m}}\text{Tc}$ -pertechnetate to the greatest extent?
 - a. stroke
 - b. subdural
 - c. meningioma
 - d. astrocytoma
 28. The unit that describes the *quantity* of a radionuclide present is based on the:
 - a. number of particles that has disintegrated
 - b. number of disintegrating atoms per unit of time
 - c. the ratio of the number of disintegrated atoms to the number of atoms not disintegrated
 - d. the mass of the radioactive atoms present
 29. A patient is diagnosed as *myxedematous*. Which of the following indications appear incongruent with this diagnosis?
 - a. elevated T_3

- b. heat intolerance
c. fine hair
d. more than one of the above
30. In the recorded test data of a renogram, which of the following can be determined?
a. renal flow rate
b. renal location
c. renal clearance
d. more than one of the above
31. The radioisotope dilution technique is employed in the determination of:
a. total blood volume determination
b. placental localization
c. splenic sequestration of RBC
d. brain scanning
32. What is the role of ascorbic acid in tagging RBC with ^{51}Cr ?
a. adjusts pH to proper value
b. prevents hemolyzation of cell for reinjection
c. oxidizes chromic ion
d. none of the above
33. If the initial activity in a patient's urine during a Schilling test is low, which of the following statements can be accurately made?
a. pernicious anemia can be diagnosed
b. patient has renal insufficiency
c. malabsorption syndrome can be definitely diagnosed
d. possible omission of flushing dose by the ward
34. The production of radioisotopes for commercial and research purposes is based on:
a. chemical activity between a stable isotope and a radioactive isotope
b. the daughter products from radioisotopic decay
c. bombardment of stable elements by subatomic particles
d. physical changes
35. In radioisotope terminology, a "carrier" is defined as:
a. a radioisotope without specific activity
b. radiation of specific wavelength
c. a stable isotope mixed with its radioisotopic form
d. none of the above
36. The biochemistry and physiology of a living organism enables it to:
a. easily distinguish between a stable isotope and its radioisotope
b. absorb the stable isotopic form preferentially
c. indiscriminately utilize a stable element or its radioisotopic form
d. absorb the radioisotopic form preferentially
37. Iodine-131 is given for thyroid therapy. Which of the following characteristics enables its use for therapy?
a. the type of emission
b. energy of emission
c. low rad value
d. toxic chemical form
38. Polycythemia vera is a condition caused by an overproduction of erythrocytes. Radioisotope therapy has been used to alleviate this condition. Which isotope is presently being used?
a. ^{85}Sr
b. ^{35}S
c. ^{198}Au
d. ^{32}P
39. Liver scanning, as we know it, was initiated about 1954. Which radiopharmaceutical has *not* been successfully utilized?
a. ^{131}I -rose bengal
b. ^{131}I -microaggregated albumin
c. ^{131}I -macroaggregated albumin
d. ^{131}I -RISA
40. You are concerned about a 100-mCi source of a 140 keV gamma emitter. Which of the following would provide adequate shielding?
a. a piece of paper
b. 2 in. of water
c. 3 in. of Lucite
d. 0.25 in. of lead
41. The isotope peak of ^{131}I is 0.364 MeV. You are instructed to calibrate this source with a conventional detector utilizing an upper and lower discriminator that should be adjusted to what setting?
a. 314–414 keV
b. 284–364 keV
c. 324–404 keV
d. 284–440 keV
42. In blood studies, ^{51}Cr and ^{59}Fe may be utilized simultaneously. Which of the following best describes the rationale for using these two nuclides?
a. the ^{59}Fe provides information about the younger erythrocytic population; ^{51}Cr provides information about the total RBC population
b. these nuclides can only be used in a laboratory with sophisticated electronic equipment
c. the ^{59}Fe provides information about the total RBC population; ^{51}Cr provides information about the younger erythrocytic population
d. at present there is no known test involving this ridiculous approach
43. Two radionuclides are simultaneously found within one organism. If the two nuclides in question are ^{51}Cr and ^{59}Fe , and specific information on the individual nuclides was desired, which of these two counting techniques, differential or integral, would be the method of choice?
a. differential counting because only a small portion of the total radioactivity is sampled
b. differential counting because isotope energies can be electronically isolated
c. integral counting because all of the organism's activity is counted
d. integral counting because the total activity of each nuclide is counted
44. A radionuclide is found to have a physical half-life of 8 days. The effective half-life is calculated to be 144 hr. Which of the following is the correct biologic half-life?
Given: $T_{\text{eff}} = \frac{T_p \times T_b}{T_p + T_b}$
a. 8.4 days
b. 24 days
c. 7 hr
d. 56 hr
45. In ^{131}I -MAA lung scanning, which of the particle size ranges describes the average size of particles used?
a. 10–15 \AA
b. 10–15 microns
c. 20–50 \AA
d. 20–50 microns
46. Scanning equipment employs a preamplifier. Which of the following best describes the function of this component? It:
a. applies high voltage to PM tube
b. decreases signal-to-noise ratio
c. increases electrical signal from PM tube
d. functionally varies from one piece of equipment to another
47. In the development of scintillation crystals, several

- chemical compounds have been used. To date, which of the following does *not* fall into this category?
- CsI
 - NaI
 - plastic
 - AgI
- The instrument console contains a *high-voltage adjustment* control. If adjustments are made with this control, its effect is noted at which of the following sites?
 - the console's power source
 - preamplifier
 - pulse-height analyzer
 - dynodes of photomultiplier tube
 - Although the crystal is encased in an aluminum can, the interface between the crystal and PM tube is lined with a thin layer of clear, silicone grease. Which of the following describes the purpose of this silicone grease?
 - holds PM and crystal together
 - acts as a "lightpipe"
 - amplifies scintillations occurring in the crystal
 - keeps the collimator from squeaking
 - Which of the following describes the relationship between the signal from the PM tube and the incident gamma ray energy?
 - directly proportional
 - inversely proportional
 - depends on collimator line-spread function
 - inversely related to collimator septal thickness
 - In activation analysis, which of the following is used as the bombarding particle?
 - alpha particles
 - beta particles
 - deuteron particles
 - neutron particles
 - You wish to obtain a source to determine proper calibration of ^{99m}Tc . Which of the following would you ideally choose?
 - ^{133}Ba
 - ^{137}Cs
 - ^{57}Co
 - ^{268}Ga
 - Which of the following is utilized in the bombardment of ^{32}S to produce ^{32}P ?
 - electron
 - proton
 - photon
 - neutron
 - Chromatography is a technique that can be used for the separation of molecular mixtures of essentially similar compounds but with differences in their coefficients of:
 - distribution (partition)
 - ionization
 - solubility
 - reaction kinetics
 - The affinity between an ion-exchange resin and different ions shows certain regularities. An ion's affinity for the resin material will be increased with an increase in the:
 - degree of hydration of the ions
 - atomic weight of ions
 - solubility coefficient of ions
 - it varies for each type of resin material
 - Which of the following tissues is the most radio-sensitive?
 - hemopoietic
 - CNS (brain)
 - cardiac
 - skeletal (epiphyseal)
 - Which of the following sequences of radionuclides is the correct order for the physical half-lives from the shortest to the longest?
 - $^{197}\text{Hg}/^{32}\text{P}/^{51}\text{Cr}/^{125}\text{I}$
 - $^{99m}\text{Mo}/^{87m}\text{Sr}/^{99m}\text{Tc}/^{113m}\text{I}$
 - $^{131}\text{I}/^{59}\text{Fe}/^{75}\text{Se}/^{203}\text{Hg}$
 - $^{60}\text{Co}/^{125}\text{I}/^{198}\text{Au}/^{57}\text{Co}$
 - At the age of 30, a radiation worker may have received a cumulated occupational exposure of:
 - 500 mrems
 - 60,000 mrems
 - 70 rems
 - 50 rads
 - You are observing a spectrum obtained from a collimated scintillation detector system monitoring a ^{131}I radioactive source. The spectrum contains a peak at 80 keV. This peak is caused by:
 - Compton scattering
 - photoelectric absorption
 - pulse-height analyzer noise
 - none of the above
 - Which of the following devices would *never* be found on a multichannel spectrum analyzer system?
 - analog-digital converter
 - magnetic core memory
 - pulse-height analyzer
 - X-Y plotter
 - Which of the following statements concerning counting statistics is *false*?
 - the randomness of radioactive decay is described by a Poisson distribution
 - the Gaussian distribution is used to analyze counting statistics in place of the Poisson distribution due to the simplification of the mathematics involved
 - one test to determine the statistical significance of radioactive measurements is satisfied by the calculated sample standard deviation which is approximately equal to the square root of the mean value of the measurements
 - when scanning a distribution radioisotope within a human body, if the counting rate is 5,000 cpm in a particular area of the body and the small region within this area provides a counting rate of 4,900 cpm, this area of decreased activity is probably due to a pathologic condition
 - Given a scintillation detection system consisting of a sodium iodide crystal, photomultiplier tube, pre-amplifier, pulse-height amplifier and scaler, which of the following statements about the system is *incorrect*?
 - the maximum uncorrected counting rate to which the system will respond is about 1 million cpm
 - the pulse-height analyzer is calibrated for energy by adjusting the high voltage applied to the photomultiplier tube
 - when the pulse-height analyzer is used in the differential mode, the window is adjusted so as to exclude the Compton scattered radiation
 - the system performance is unaffected by room temperature and humidity
 - Which of the following statements referring to radioactive decay is *false*?
 - alpha and beta decay both involve the emission of particles from within a nucleus
 - gamma decay can result from alpha and beta decay processes

- c. the neutrino is produced in a beta decay to conserve momentum of the system
d. the daughter nucleus in an electron-capture process will have a lower mass than the initial parent nucleus
64. You have sent a specimen to the nuclear medicine laboratory for T_3 and T_4 tests on a girl who was normal last year and who you now suspect is pregnant. If she is pregnant the results will be:
- T_3 and T_4 both lower
 - T_3 and T_4 both higher
 - T_3 higher and T_4 lower
 - T_3 lower and T_4 higher
65. Plasma has as its components:
- albumin and globulin
 - fibrogen
 - globulin
 - all of the above
66. While injecting the tagged cells for a red blood cell mass, part of the cells went subcutaneous. You would have:
- a normal RBC mass
 - a high RBC mass
 - a low RBC mass
 - results depending on the rest of the test
67. On day 1 of the ferrokinetic study, where would you expect the majority of the radioactive iron to be in a normal patient?
- liver
 - spleen
 - bone marrow
 - liver and spleen
68. Assume you are a physician taking care of a patient with possible pernicious anemia. You order a Schilling's test and the results come back 45%. Do you think:
- the results are normal
 - that there may be an incomplete urine collection
 - that the ward forgot to give the flushing dose
 - the patient vomited right after swallowing the capsule
69. In a T_4 test we extract with 95% ethanal. Therefore we are:
- directly measuring T_4
 - indirectly measuring T_4
70. In a T_3 test we do not extract with ethanal. Therefore we are:
- directly measuring T_3
 - indirectly measuring T_3
71. The highest total-body dose that would *not* be expected to cause death to any person is about:
- 50 rads
 - 100 rads
 - 300 rads
 - 500 rads
72. The cause of death in the LD_{50} dose range is due to:
- destruction of bone marrow stem cells
 - intestinal damage
 - nausea, vomiting, and diarrhea
 - radiation sickness
73. The CNS syndrome results from all of the following *except*:
- nerve cell impairment
 - vascular damage
 - edema
 - stem cell death
74. When LET is described as X keV/micron, X is:
- constant at all points along the path
 - the energy expended per ionization
 - the same for all radiations
 - an average value
75. The energy from all ionizing rays and particles in the final analysis is transferred to a biologic system via:
- bremsstrahlung
 - photons
 - slow-moving electrons
 - direct effect
76. Technetium-sulfur colloid injected intravenously should *not* normally localize in which of the following organs?
- spleen
 - bladder
 - liver
 - bone marrow
77. Rose bengal is taken up by which of the following cells?
- polygonal cells in liver
 - RES in spleen
 - Kupffer cells in liver
 - sinusoids in bone marrow
78. Free ^{99m}Tc in a technetium sulfur colloid preparation would be visualized in which of the following areas?
- stomach
 - liver
 - spleen
 - heart
79. Which of the following concerning $^{113m}\text{InCl}_3$ is false?
- physical half-life of 1.7 hr
 - can be tagged to transferrin component of blood
 - can be chelated for bone scanning
 - is obtained as a decay product of ^{113}Sn
80. Mercury-197-Neohydrin does not differ from ^{203}Hg -Neohydrin in which of the following ways?
- ^{203}Hg -Neohydrin has a longer biologic half-life
 - ^{197}Hg -Neohydrin has a shorter effective half-life
 - ^{203}Hg -Neohydrin results in a greater radiation dose to the kidneys (assuming equivalent amounts administered)
 - none of the above
81. The plasma volume of a patient can be determined with which of the following agents?
- ^{133}Xe in saline
 - $^{99m}\text{NaTcO}_4$
 - ^{99m}Tc -human serum albumin
 - none of the above
82. The tagging efficiency of ^{99m}Tc -sulfur colloid can be determined by which of the following methods?
- gas chromatography
 - thin layer chromatography
 - centrifugation
 - microscopy
83. The maximum volume of ^{131}I -human serum albumin that can be injected for cisternography is governed by the:
- optimum counting rate desired
 - volume of the subarachnoid space
 - radiation dose to the spinal cord
 - amount of protein contained in the injection
84. Indium-113m, ^{99m}Tc , and ^{87m}Sr have which of the following characteristics in common?
- they are all short-lived daughter isotopes of long-lived parents
 - none of them are organ specific in normal individuals
 - they are all cations
 - more than one of the above

85. In sequential brain studies, it is our purpose to learn more about the mechanisms of ^{99m}Tc -pertechnetate localization in lesions, defined as any abnormal area of uptake in the brain. Which one of the following is *not* a reason for better visualization of a brain tumor as postinjection time increases?
- uptake by the tumor cells
 - increased activity seen in salivary glands in proportion to the normal distribution of radioisotope in the brain
 - the clearance blood radioactivity in the normal brain tissue reduces background around the tumor
 - the clearance mentioned in (c) decreases the percentage of total collected counts coming from normal structures; therefore a higher percentage of counts comes from the tumor
86. At the present time the MTF is used to quantitate information regarding the loss of collimator resolution due to septal penetration. The FWHM has also been used as a measure of resolution. Which statement is true?
- the MTF is better because it measures all of a line-spread function for degradation, not just at the FWHM since the worst degradation takes place below the FWHM
 - the less accurate information derived from the FWHM compared to the MTF is acceptable because of the complex procedure of computing an MTF
 - the FWHM is better because it disregards the worst information coming from points furthest from the focused collimator axis whereas the MTF utilizes all points on the line spread causing distortion of the overall resolution
 - the MTF is best because it disregards the information arising from points farthest from the axis whereas the FWHM equally considers all points on a line spread
87. Information density (ID) is an important scanning parameter to keep in mind for uniform scan comparison from patient to patient. The correct ID formula is:
- $\text{ID} = \frac{\text{line spacing}}{\text{speed} \times \text{cpm}}$
 - $\text{ID} = \frac{\text{cpm}}{\text{speed} \times \text{line spacing}}$
 - $\text{ID} = \frac{\text{speed}}{\text{cpm} \times \text{line spacing}}$
 - $\text{ID} = \frac{\text{speed} \times \text{line spacing}}{\text{cpm}}$
88. The advantages of radioimmunoassays are that they are:
- fast and accurate
 - simple and specific
 - specific and sensitive
 - reproducible and convenient
89. The ideal particle size range for colloids used in liver scanning procedures is identified by which of the following?
- 50–75 Å
 - 5–10 microns
 - 0.1–2.0 microns
 - 10–20 microns
90. The function of a pulse-height analyzer is best described by which of the following?
- selects the base line of energy spectrum being analyzed
 - selects the window width
 - enables the use of a differential counting modality
 - all the above
91. The first patient of the day has a thyroid scan; the scan is technically satisfactory. The second patient has a brain scan that is of suboptimal technical quality (i.e., the scan is darkened and containing little, if any, technical information). Which of the following suspected problems could *not* cause the above result?
- improper adjustment of photopeaks
 - failure to change collimators
 - background erase set too high
 - a change in high voltage supply to detector
92. Which of the following may be considered a tumor-detecting agent in scanning?
- Technetium-pertechnetate
 - Gallium-citrate
 - Selenium-selenomethionine
 - All of the above
93. A combined transmission and colloidal liver scan is especially helpful in detecting:
- hematoma of the liver
 - basal perfusion defect of the lung
 - subphrenic abscess
 - pericardial effusion
94. Which of the following would be best for placental scan?
- ^{99m}Tc -pertechnetate
 - ^{131}I -serum albumin
 - ^{113m}In -transferrin
 - ^{51}Cr tagged red cells
95. The highest radiation dose to the liver during liver scanning with normal doses is given by:
- ^{99m}Tc -sulfur colloid
 - ^{198}Au -colloid
 - ^{131}I -albumin colloid
 - ^{131}I -rose bengal
96. Which of the following is a disadvantage concerning *short* half-lived radionuclides?
- counting statistics
 - radiation to the patient
 - production and quality control
 - repeatability of study at intervals
97. A current of 1.2 mA flows through a resistor due to a potential difference of 1.2 kV. Using Ohm's Law ($V = IR$), what is the value of this resistor?
- 2400 ohms
 - 100,000 ohms
 - 1,000,000 ohms
 - 1,000 ohms
98. Of the following radionuclides, which best utilizes the capabilities of the Anger camera?
- ^{198}Au
 - ^{137}Cs
 - ^{59}Co
 - ^{99m}Tc
99. The rem is a unit of measurement indicating:
- air dose
 - maximum permissible dose
 - animal biologic dose
 - none of the above
100. X-rays are described as being an extranuclear phenomenon. In similar terms, how may gamma rays be described?
- an intranuclear phenomenon
 - an extranuclear phenomenon
 - an internuclear phenomenon

- d. it depends on the radioisotope being considered
101. In obtaining quantitative data, errors are possible and must be accounted for. Which of the following is an example of an *indeterminate* source of error?
- equipment malfunction
 - geometric factors
 - backscattering
 - randomness of radioactive decay
102. During which of the following finite time intervals is radioactive detecting equipment insensitive to other ionizing events?
- dead time
 - resolving time
 - recovery time
 - lunch time
103. Strontium-90 is considered extremely toxic because:
- it is a beta emitter
 - it has a long effective half-life
 - it is a bone seeker
 - all of the above
104. The yearly whole-body MPD for radiation workers at the present time is:
- 1.25 rems
 - 18.75 rems
 - 5 rems
 - 12 rems
105. Ratemeters and scalers that are components of radioactive detecting equipment are:
- pulse counters
 - proportional counters
 - scintillation detectors
 - auxiliary recording devices
106. Which of the following beta-emitting isotopes would be expected to count with the highest efficiency in a liquid scintillation spectrometer's flow cell?
- ^{32}P
 - ^{14}C
 - ^{35}S
 - tritium
107. Which of the following formulas can be used to determine the counting efficiency of a sample to which an internal standard (IS) has been added?
- $$\text{Eff.} = \frac{\text{cpm observed} + \text{cpm of IS}}{\text{dpm of IS}} (100)$$
 - $$\text{Eff.} = \frac{(\text{cpm IS} + \text{sample}) + (\text{dpm of sample})}{(\text{dpm IS}) - (\text{cpm sample})} (100)$$
 - $$\text{Eff.} = \frac{(\text{cpm of IS}) - (\text{cpm of sample})}{\text{dpm IS}}$$
 - $$\text{Eff.} = \frac{(\text{cpm of IS} + \text{sample}) - (\text{cpm of sample})}{\text{dpm IS}}$$

Continuing Education Assessment Examination

Answer Sheet

Directions: Make a photocopy of this answer sheet and complete the examination without consulting textbooks or reference materials. Do *not* enter your name on the answer sheet. Send the answer sheet to the Continuing Education Committee via the National Office: Society of Nuclear

Medicine, 475 Park Avenue South, New York, N.Y. 10016. Keep a copy of the completed answer sheet so you can check your answers against those published in the June issue. Don't forget to check the appropriate boxes below.

Type of NMT Training

- Rad. Tech. + 1 yr AMA approved
- Rad. Tech. + 2-5 yr on-job-training
- Rad. Tech. + 1 yr non-AMA approved
- B.S. + 1 yr AMA approved
- 2-yr A.S. NMT
- B.S., NMT program
- ASCP + 1 yr
- Other _____

Years of Experience

- 1-2
- 2-4
- 4-6
- 6-10
- More than 10

Type of Facility (Present Employment)

- University Medical Center
- Community Hospital
 - Less than 300 beds
 - 300-500 beds
 - More than 500 beds
- Clinic or private office
- V.A. or military hospital

Department is a Division of

- Radiology
- Pathology
- Internal Medicine
- Other _____

1.	a	b	c	d	28.	a	b	c	d	55.	a	b	c	d	82.	a	b	c	d
2.	a	b	c	d	29.	a	b	c	d	56.	a	b	c	d	83.	a	b	c	d
3.	a	b	c	d	30.	a	b	c	d	57.	a	b	c	d	84.	a	b	c	d
4.	a	b	c	d	31.	a	b	c	d	58.	a	b	c	d	85.	a	b	c	d
5.	a	b	c	d	32.	a	b	c	d	59.	a	b	c	d	86.	a	b	c	d
6.	a	b	c	d	33.	a	b	c	d	60.	a	b	c	d	87.	a	b	c	d
7.	a	b	c	d	34.	a	b	c	d	61.	a	b	c	d	88.	a	b	c	d
8.	a	b	c	d	35.	a	b	c	d	62.	a	b	c	d	89.	a	b	c	d
9.	a	b	c	d	36.	a	b	c	d	63.	a	b	c	d	90.	a	b	c	d
10.	a	b	c	d	37.	a	b	c	d	64.	a	b	c	d	91.	a	b	c	d
11.	a	b	c	d	38.	a	b	c	d	65.	a	b	c	d	92.	a	b	c	d
12.	a	b	c	d	39.	a	b	c	d	66.	a	b	c	d	93.	a	b	c	d
13.	a	b	c	d	40.	a	b	c	d	67.	a	b	c	d	94.	a	b	c	d
14.	a	b	c	d	41.	a	b	c	d	68.	a	b	c	d	95.	a	b	c	d
15.	a	b	c	d	42.	a	b	c	d	69.	a	b	c	d	96.	a	b	c	d
16.	a	b	c	d	43.	a	b	c	d	70.	a	b	c	d	97.	a	b	c	d
17.	a	b	c	d	44.	a	b	c	d	71.	a	b	c	d	98.	a	b	c	d
18.	a	b	c	d	45.	a	b	c	d	72.	a	b	c	d	99.	a	b	c	d
19.	a	b	c	d	46.	a	b	c	d	73.	a	b	c	d	100.	a	b	c	d
20.	a	b	c	d	47.	a	b	c	d	74.	a	b	c	d	101.	a	b	c	d
21.	a	b	c	d	48.	a	b	c	d	75.	a	b	c	d	102.	a	b	c	d
22.	a	b	c	d	49.	a	b	c	d	76.	a	b	c	d	103.	a	b	c	d
23.	a	b	c	d	50.	a	b	c	d	77.	a	b	c	d	104.	a	b	c	d
24.	a	b	c	d	51.	a	b	c	d	78.	a	b	c	d	105.	a	b	c	d
25.	a	b	c	d	52.	a	b	c	d	79.	a	b	c	d	106.	a	b	c	d
26.	a	b	c	d	53.	a	b	c	d	80.	a	b	c	d	107.	a	b	c	d
27.	a	b	c	d	54.	a	b	c	d	81.	a	b	c	d					