QUIZ: Radionuclide Generators, Generator QC

1. The Tc-99m eluted from the Mo-99/Tc-99m generator is in the chemical form of

    a) pertechnetate ($Tc0_4$)
    b) hydrolyzed reduced Tc, e.g. $Tc0(OH)_2.(H_20)$
    c) Technetium hydroxide, e.g. $Tc(OH)_4$
    d) Technetium sulfate, e.g. $Tc(S0_4)_2$
    e) None of the above

2. The parent/daughter relationship in a Mo/Tc generator is a classical example of

    a) dynamic stability
    b) secular equilibrium
    c) transient equilibrium
    d) reverse isomeric transition
    e) none of the above

3. Which of the following is/are true for transient equilibrium:

    a) at equilibrium, the physical half-life of the daughter equals the physical half-life of the parent
    b) at equilibrium, the physical half-life of the daughter is 10 times as great as the physical half-life of the parent
    c) at equilibrium, the apparent half-life of the parent equals the physical half-life of the daughter
    d) at equilibrium, the apparent half-life of the daughter equals the physical half-life of the parent
    e) none of the above

4. In the Mo/Tc generator, separation of the daughter from the parent is based on

    a) electrophoretic separation
    b) gravity separation
    c) in-vivo separation
    d) chromatographic separation

5. The chromatography column in a Mo-99/Tc-99m generator contains

    a) aluminum chlorohydrate
    b) aluminum hydroxide
    c) aluminum oxide
    d) silica gel
    e) none of the above

6. The Mo/Tc generator is eluted with

    a) 0.001M hydrochloric acid
    b) sterile distilled water
    c) physiological saline
    d) none of the above

7. We analyze the generator eluate for impurities. These include

a) free Tc, Al^{3+} ion, Mo^{99}
b) free Tc, Mo^{99}, Hydrolyzed Reduced Tc
c) Al^{3+} , Mo^{99}, Hydrolyzed Reduced Tc
d) free Tc, Hydrolyzed Reduced Tc
e) perchlorate, molybdate

8. After a molybdenum-99/technetium-99m generator is eluted with typical efficiency, the in-growing Tc-99m reaches a maximum

a. at about 2 hours
b. between 2 and 6 hours
c. between 6 and 12 hours
d. between 12 and 24 hours
e. only after 30 hours

9. In an equilibrium mixture of parent molybdenum-99 and daughter Tc-99m, the ratio of Tc-99m activity to Mo-99 activity is:

a. greater than 2
b. about 1.5
c. about 1.1
d. about 0.98
e. about 0.7

10. Tc-99m formed in the Mo/Tc generator decays to radioactive Tc-99g which has a half life of 2.1 $x10^5$ years. Tc-99g does not contribute significantly to absorbed dose in in vivo procedures because:

a. Tc-99g does not emit particulate radiation as it decays
b. It is rapidly cleared from the body
c. The number of atoms of ^{99g}Tc is small compared with the number of atoms of ^{99m}Tc
d. The activity of Tc-99g is small compared with the activity of Tc-99m

11. Which of the following are essential for a practical laboratory radionuclide generator?

a. Daughter must have a longer half life than parent
b. Daughter must have a shorter half life than parent
c. Daughter half life must not be less than one hour
d. Parent must not decay to daughter by isomeric transition
e. Parent must not decay to daughter by isobaric transition

12. In the Mo/Tc generator, the elution of technetium by saline solution produces a separation from molybdenum because:

a. The molybdenum is in the form of insoluble metal
b. The molybdenum chloride is insoluble
c. The molybdate is absorbed on alumina, whereas pertechnetate is not
d. None of the above

13. What is the limit of aluminum ion concentration in eluate from a fission Mo generator?

    a. l00 μg per ml
    b. 20 μg per ml
    c. l μg per ml
    d. 2 μg per ml
    e. l0 μg per ml

14. The radionuclide impurities in Tc-99m pertechnetate eluate can be determined by

    a. dose calibrator
    b. GM counter
    c. multichannel analyzer
    d. Cutie Pie

15. The legal limit for Mo-99 breakthrough is

    a. 1 μCi Mo-99/mCi Tc-99m at time of elution
    b. 1 μCi Mo-99/mCi Tc-99m at time of injection
    c. 0.15 μCi Mo-99/mCi Tc-99m at time of elution
    d. 0.15 μCi Mo-99/mCi Tc-99m at time of administration
    e. None of the above

16. The Tc-99m eluate at 7:00 A.M. this morning had a ratio of 0.10 μCi Mo-99/mCi Tc-99m. Mark the following statements True/False:

    a. This ratio decreases as a function of time
    b. If the generator were eluted again at 8:00 A.M., no activity would be obtained due to a shortened waiting period
    c. It would it be permissible to use this product in humans at 10:00 A.M.
    d. Equilibrium is reached 12 hours after the previous elution

17. For the existence of radioactive equilibrium, True/False:

    a. half-life of the parent is greater than the half-life of the daughter
    b. number of atoms of the parent exceeds the number of atoms of the daughter.
    c. parent must decay to a metastable state of the daughter
    d. daughter must be stable

18. In transient equilibrium, the ratio of parent's half-life to daughter's half-life is approximately

    a. 1
    b. 10
    c. 50
    d. 100
    e. 1000

19. A Mo-99/Tc-99m generator has a useful life of

    a. 1 hour
    b. 1 day
    c. 1 week
    d. 2 weeks
    e. 1 month

20. The cylindrical lead shielding in a Mo/Tc generator is 2 inches thick and weighs approximately 48 pounds. This large quantity of lead is required to shield

    a. The Tc-99m
    b. The Mo-99
    c. Both the Mo and the Tc
    d. Neither of these isotopes