1. The periodic table is organized into _____ and _____.
    a. groups, periods
    b. groups, types
    c. blocks, groups
    d. blocks, types

    Answer: A

2. All elements in a period have _____
    a. different number of electron shells
    b. similar chemical and physical characteristics
    c. same number of electron shells
    d. different physical, but similar chemical characteristics.

    Answer: C

3. The two axes of the Chart of the Nuclides represent the number of _____ and _____.
    a. neutrons, electrons
    b. neutrons, positrons
    c. protons, electrons
    d. protons, neutrons

    Answer: D

4. The periodic table represents _____ whereas the Chart of the Nuclides represents _____.
    a. elements, groups
    b. elements, isotopes
    c. groups, periods
    d. groups, isotopes

    Answer: B

5. On the Chart of the Nuclides, a solid gray square represents the isotope is _____.
    a. naturally radioactive
    b. stable
    c. artificially radioactive
    d. fissionable

    Answer: B

6. The elements that fall along the line of stability on the Chart of the Nuclides have an equal number of _____ and _____.
    a. protons, neutrons
    b. protons, electrons
    c. neutrons, electrons
    d. neutrons, positrons

    Answer: A

7. Isotopes that reside on the upper end of the line of stability on the Chart of the Nuclides undergo radioactive decay by _____.
    a. electron capture
    b. spontaneous fission
    c. positron release
    d. alpha particle release

    Answer: D

8. In _____, the nucleus splits into unequal parts with a large amount of energy.
    a. thermal fission
    b. spontaneous fission
    c. nuclear fission
    d. intermediate fission

    Answer: C

9. When a nucleus undergoes _____, the fission fragments have excess neutrons and undergo beta decay.
    a. thermal fission
    b. spontaneous fission
    c. intermediate fission
    d. nuclear fission

    Answer: B

10. The most important factor in a complexation reaction is the _____.
    a. valence state
    b. physical state
    c. radioactive half-life
    d. chemical form

    Answer: A

11. _____ occurs when ions in an aqueous solution form an insoluble ionic solid.
    a. dissolution
    b. segregation
    c. polarization
    d. precipitation

    Answer: D

12. The separation or partitioning of radioisotopes in liquid solutions is performed by _____.
    a. evaporation
    b. precipitation
    c. solvent extraction
    d. complexation

    Answer: C

13. _____ reactions are a function of a metal atom or ion's ability to join with compounds that have pairs of electrons to donate.
    a. complexation
    b. separation
    c. complexation
    d. precipitation

    Answer: A

14. The attraction of a specific ion to a given ion exchange resin is known as _____.
    a. equilibrium
    b. selectivity
    c. preference
    d. attraction

    Answer: B

15. To selectively remove an ion from ion exchange resin, it may be necessary to add _____ and adjust _____ to get the best result.
    a. carrier, flow
    b. acid, pH
    c. caustic, temperature
    d. carrier, pH

    Answer: D

16. Carriers not only carry along small amounts of the radioisotope, but also help determine _____.
    a. isotopic yield
    b. chemical composition
    c. isotopic composition
    d. chemical yield

    Answer: D

17. Carriers provide the ability to extract a desired radioisotope by adding a _____ similar stable isotope to the sample.
    a. biologically
    b. radioactively
    c. chemically
    d. isotopically

    Answer: C

18. In selecting an isotopic carrier to a sample, care should be taken to ensure that the carrier has the same _____ and _____ as the nuclide to be analyzed.
    a. oxidation state, chemical form
    b. oxidation state, mass number
    c. chemical form, density
    d. chemical form, solubility

    Answer: A

19. Tracers are used so that the _____ of the chemical separation can be monitored.
    a. activity
    b. yield
    c. purity
    d. solubility

    Answer: B

20. One important issue that should be considered that should be considered when choosing a tracer is _____.
    a. health hazards of the tracer
    b. cost of the tracer
    c. disposal costs
    d. time necessary for preparation

    Answer: A

21. Limiting factors such as the chemical form at the tracer level and _____ make the selection of an ideal carrier difficult.
    a. chemical properties
    b. cost
    c. chemical impurities
    d. availability

    Answer: C

22. Gas proportional counters operate on the principle of the _____ of gas molecules by decay particles to generate a pulse.
    a. destruction
    b. combination
    c. acceleration
    d. ionization

    Answer: D

23. The two factors that contribute to ion pair production in gas proportional counters are _____ and _____.
    a. charge potential, high electron charge
    b. charge potential, high electron density
    c. low electron density, low charge density
    d. low electron density, high charge density

    Answer: B

24. Gas proportional counters may be used to count and analyze _____ and _____ radiation.
    a. alpha, gamma
    b. beta, gamma
    c. gamma, x-ray
    d. alpha, beta

    Answer: D

25. The primary disadvantage of gas proportional counting systems is _____.
    a. sample preparation
    b. sample size
    c. sample activity
    d. sample density

    Answer: A

26. The primary advantage of gas proportional counting system is its _____ in counting alpha and beta nuclides of various energies.
    a. versatility
    b. accuracy
    c. precision
    d. speed

    Answer: A

27. _____ and _____ can aid in the elimination of errors in gas proportional counting data.
    a. Lower count rates, thicker detector windows
    b. Larger sample sizes, good techniques
    c. Pulse height discriminators, clean separations
    d. Higher activity samples, short counting times

    Answer: C

28. When performing alpha analysis using gas proportional counting, source and samples must be _____ and _____for maximum detection capability.
    a. thick, moist
    b. thin, uniform
    c. thin, moist
    d. thick, uniform

    Answer: B

29. The attenuation of alpha particles in a sample that is too dense or has an uneven surface is called _____.
    a. self-shielding
    b. self-annihilation
    c. self-assistance
    d. self-absorption

    Answer: D

30. Alpha counting data errors commonly occur because of _____
    a. crossfire
    b. crossover
    c. crosstalk
    d. cross-intimidation

    Answer: C

31. When reviewing a gas proportional spectrum containing both alpha and beta counts, the alpha counts should appear at the ____ of the spectrum
    a. lower end
    b. middle
    c. upper end
    d. none of the above

    Answer: A

32. Liquid scintillation counters rely on the interaction of the _____ and the _____ producing light photons.
    a. beta particles, photocathode tube
    b. phosphor, photomultiplier tube
    c. beta particles, phosphor
    d. beta particles, photomultiplier tube

    Answer: C

33. What color light is emitted in a scintillation counter?
    a. White
    b. Blue
    c. Red
    d. Green

    Answer: B

34. Liquid scintillation counting is unique in that it _____.
    a. samples must be dark adapted
    b. detector requires a high voltage
    c. moves particles using a carrier gas
    d. requires extensive sample preparation

    Answer: A

35. Coincidence counting in liquid scintillation counters describes the _____.
    a. ability to sum all counts simultaneously
    b. ability to send multiple light signals to the multi-channel analyzer
    c. ability to count background samples at the same time
    d. ability to detect light in two photomultiplier tubes

    Answer: D

36. The liquid scintillation counting system is primarily used to count _____ radiation; however, _____ radiation can be counted on a limited basis.
    a. beta, gamma
    b. alpha, gamma
    c. alpha, beta
    d. beta, alpha

    Answer: D

37. The most common interference associated with liquid scintillation counting is _____.
    a. absorption
    b. masking
    c. quench
    d. shielding

    Answer: C

38. Liquid scintillation counting error can be caused by _____.
    a. chemicals, color, and opacity
    b. chemicals, time, and opacity
    c. chemicals, color, and particulates
    d. color, particulates, and density

    Answer: A

39. In a gamma spectroscopy system, the energy that is produced as a result of the number of _____ that are produced when the gamma ray strikes the detector.
    a. photons
    b. electrons
    c. protons
    d. neutrons

    Answer: B

40. The transfer of energy to an inner shell electron during a gamma ray interaction occurs because of _____.
    a. photoelectric effect
    b. pair production
    c. Compton scattering
    d. self-absorption

    Answer: A

41. The interaction of a gamma ray with an inner shell electron, resulting in an electron along with a photon escaping is known as _____.
    a. photoelectric effect
    b. recoil scattering
    c. pair production
    d. Compton scattering

    Answer: D

42. The two most common types of gamma detectors are _____ and _____.
    a. Semi-conductor, proportional
    b. scintillation, Geiger-Mueller
    c. scintillation, semi-conductor
    d. semi-conductor, ionization

    Answer: C

43. The most common material used for gamma ray scintillation detectors is _____.
    a. potassium chloride
    b. sodium iodide
    c. sodium chloride
    d. germanium

    Answer: B

44. Germanium is used in gamma counting systems because it _____.
    a. has better peak resolution
    b. is very mobile
    c. has a long half-life
    d. has a higher efficiency factor.

    Answer: A

45. Lowering the temperature of a germanium detector increases _____.
    a. reaction time
    b. geometry
    c. stopping power
    d. cost

    Answer: C

46. Liquid nitrogen cooled gamma counting systems that are not cooled adequately are susceptible to:
    a. vibration
    b. condensation
    c. static electricity
    d. electronic noise

    Answer: D

47. One advantage of scintillation gamma detectors over other types is _____.
    a. Power considerations
    b. mobility
    c. range of isotope identification
    d. cross-talk

    Answer: B

48. Errors in gamma spectroscopy systems can be attributed to either _____ or _____.
    a. system performance, interpretation of data
    b. system performance, inadequate count time
    c. lack of vendor support, sample preparation
    d. environmental factors, operator error

    Answer: A

49. A key consideration when preparing samples for gamma counting is _____.
    a. density
    b. color
    c. geometry
    d. sample source

    Answer: C

50. The gamma counting efficiency of a liquid sample can be increased by _____.
    a. reducing the count time
    b. shielding the sample
    c. reducing the overall geometry size
    d. increasing the cooling of the detector

    Answer: C

51. Gamma spectroscopy peaks should be _____.
    a. Wide to contain more counts
    b. Narrow to isolate different energies
    c. Combined with other isotope energies to ensure adequate counting
    d. Different each time a same is counted due to decay

    Answer: B

52. Alpha spectroscopy counting takes place in _____.
    a. a nitrogen filled detector
    b. a helium gas chamber
    c. in a clean-room environment
    d. in a vacuum chamber

    Answer: D

53. Due to a _____, alpha spectrometers must possess adequate resolution to readily identify individual isotopes.
    a. small range of energies
    b. large range of energies
    c. large number of isotopes
    d. small number of isotopes

    Answer: A

54. Alpha spectroscopy is subject to cross-talk from _____.
    a. low-energy beta emitters
    b. high-energy beta emitters
    c. gamma radiation
    d. radiofrequency interference

    Answer: B

55. The most common type of isotope separation is _____.
    a. fluoride precipitation
    b. electro-plating
    c. sample evaporation
    d. alpha energy isolation

    Answer: A

56. The primary disadvantage of alpha spectroscopy is _____.
    a. high cost of operation
    b. low detector efficiency
    c. extensive sample preparation
    d. long counting times

    Answer: C

57. Alpha particles have _____ travel distances compared to other radioactive particles.
    a. short
    b. long
    c. unpredictable
    d. mid-range

    Answer: A

58. One cause of alpha detector contamination is _____.
    a. beta energy in the detector
    b. Loose sample material
    c. Loss of nitrogen cooling
    d. low sample counts

    Answer: B

59. In alpha spectroscopy, what is a region of interest (ROI)?
    a. An area of the detector that has a higher efficiency.
    b. The average of an isotope's energy profile.
    c. A range of channels where a specific isotope is found.
    d. The common energy of the most likely isotope.

    Answer: C

60. The mean rate at which a nuclide decays is called it's _____.
    a. carrier ratio
    b. efficiency
    c. recovery
    d. activity

    Answer: D

61. _____ is the ratio of the amount of analyte present in a spiked sample to the amount of analyte added, expressed as a percentage.
    a. Activity
    b. Recovery
    c. Efficiency
    d. Attenuation factor

    Answer: B

62. The decay constant can be used in radiochemistry activity calculations to _____.
    a. determine sample activity at a given point in time
    b. correct for background errors
    c. calculate the amount of radiation received during decay
    d. determine whole-body dose rates for sample analysts

    Answer: A

63. _____ is a source of counting error.
    a. Geometry
    b. Continuous discharge
    c. Self-absorption
    d. Random disintegration

    Answer: C

64. The term _____ _____ refers to the time interval which must elapse after a pulse is counted before another pulse can be detected.
    a. resolving time
    b. rest time
    c. down time
    d. recovery time

    Answer: A

65. A laboratory technician is subject to error in radiochemistry processes because of _____.
    a. self-absorption
    b. sample geometry
    c. reagent purity
    d. inattention to detail

    Answer: D

66. A radiochemistry analysis error related to human performance is _____.
    a. equipment failure
    b. cross-contamination
    c. high counting background
    d. instrument efficiency

    Answer: B

67. The first legislation dealing with nuclear waste was called the _____.
    a. Comprehensive Environmental Response, Compensation, and Recovery Act (CERCLA)
    b. Atomic Energy Act
    c. Nuclear Waste Policy Act
    d. Radioactive Waste Disposal Act

    Answer: B

68. The regulation regarding radioactive waste currently guiding cleanup in the United States is enforced by the _____.
    a. Environmental Protection Agency
    b. Department of Energy
    c. Department of Homeland Security
    d. Nuclear Regulatory Commission

    Answer: A

69. 40 CFR – Part 191 was specifically written for wastes created _____.
    a. during laboratory operations
    b. from nuclear bomb testing
    c. during production of nuclear weapons
    d. from disposal of nuclear reactor fuel

    Answer: C

70. Transuranic wastes contain elements with atomic numbers greater than _____.
    a. 100
    b. 78
    c. 118
    d. 92

    Answer: D