RSM 2019

1. Which of following is the correct description for specificity of nuclear force?

A) The nuclear force is worked with gravitation and repulsion.

B) It is the force in a long distance.

C) The nuclear force is not related with spin direction of nucleus

D) The characteristic of nuclear force has saturation.

E) It has the quark exchange power.

2. What is the correct answer for the energy value about one stopped electron?

A) 0.511 MeV

B) 1.022 MeV

C) 931.5 MeV

D) 939.5 MeV

E) 13.6 MeV

3. Which is the following description is correct for the X-ray generator?

A) Most of X-ray from the X-ray generator is the characteristic X-ray.

B) If the tube voltage is represented as kVcp, it means the voltage is pulse form.

C) If increase the tube current with fixed tube voltage, radiated X-ray moves to the direction of long-wavelength.

D) The electronic energy is emitted with thermal energy in the X-ray generator

E) If increase the tube voltage with fixed tube current, radiated X-ray amount will be decreased.

4. Which sentence is the correct answer?

A) The Auger electron emission occurs from the atom of lower atomic number generally.

B) The summation of every fraction of the composition of internal conversion electron factor.

C) The internal conversion competitively occurs with characteristic X-ray radiation

D) The internal conversion normally occurs in external orbital electron

E) The internal conversion electron has continuous spectrum.

5. Which reaction is the greatest effect in the interaction between a substance and Alpha and Beta ray?

A) elastic scattering

B) inelastic scattering

C) Cherenkov effect

D) Rayleigh scattering

E) nuclear reaction

6. Which is the most correct answer in radiation?

A) The decay constant is the probability that 1 atomic nucleus is decayed in an unit time.

B) The half-life is 1.44 times of mean-life.

C) The decay constant is great, the radionuclide is slowly decayed.

D) The half-life is theoretically longer than mean-life

E) The nuclide is stable when half-life is shorter

7. Which answer is correct for the pair of radionuclides and their half-life?

A) Co-60 : 5.31 days

B) I-131 : 8 hours

C) Cs-137 : 30 years

D) Sr-90 : 64 hours

E) Ir-192 : 8 days

8. Which sentence is correct answer?

A) The electron number is 28 that is able to fill up as far as M edge in the atom.

B) The binding energy is fixed with 7~8 MeV regardless the nuclide.

C) When get a new nucleus B from the collision between an accelerated proton and a target nucleus A, the generated nucleus is the isotone of the target nucleus.

D) If the mass number, the specific binding energy is increased.

E) The nuclide which has greatest specific binding energy is C-12.

9. Which is the correct answer for pair of unit in radioactivity?

A) C/kg, J/kg

B) Gy, Sv

C) Gy/h, Sv/h

D) dps, Gy/h

E) Ci, Bq

10. What is the phenomenon that the alpha rays probabilistically break through potential barriers with energy higher than their energy?

A) Moseley's law

B) Tunnel effect

C) Bergoni-Tribondeau's law

D) Bragg-gray principle

E) Cherenkov phenomenon

11. What is the nuclide for the smallest binding energy per a nucleon?

A) H-1

B) He-4

C) C-12

D) O-16

E) Fe-56

12. What radiation is that the parent nuclide emits the daughter nuclide with an electron capture?

A) Alpha-ray

B) Beta-ray

C) Neutrino

D) Anti-neutrino

E) Infra-red

13. Which is the correct answer for the electron capture?

A) emits a positron and characteristic X-ray

B) emits neutrino and characteristic X-ray

C) emits internal conversion electron at the same time

D) Mass number is decreased by 4

E) Atomic number is increased by 1

14. Which has a linear spectrum distribution?

A) Neutrino from the electron capture

B) Bremsstrahlung ray

C) Electron-pair production

D) Beta ray

E) Compton scatter

15. Which is the correct explanation for K-edge of an atom?

A) Kinetic energy is lowest.

B) Potential energy is highest.

C) Velocity of electron is fastest.

D) Energy level is highest.

E) The largest number of electron which fill up in K-edge is 4.

16. What is the phenomenon that the exposed gamma ray gives its energy to the electrons in the atoms and become extinct itself?

A) Compton scatter

B) Electron-pair production

C) Triple-electon production

D) Photo-electric effect

E) Photonuclear reaction

17. Which is the correct explanation for an atom's energy level?

A) Atom's excitation is unstable.

B) K-edge's energy level is highest.

C) Photon is emitted when the atom moves ground state to excited state

D) When the electron is far from nucleus, the bigger the binding energy with nucleus.

E) Atom's orbital has continuous energy state in Bohr's atom model.

18. What is the correct answer?

A) Proton is heavier than neutron.

B) Neutron's mass is bigger than proton's mass.

C) Substance's mass decreases when its velocity is close to the velocity of light.

D) Neutron's stopped mass is almost same as 1840 times of proton's mass.

E) Nuclear force is the force between a nucleus and a electron.

19. What is the element that has a different number of composed neutrons, but the same number of protons, and atomic number and chemical characteristics?

A) Rare-earth element

B) Isomer

C) Isotone

D) Isobar

E) Isotope

20. What is the correct answer for the electro-magnetic wave?

A) The electro-magnetic wave has a mass.

B) The X-ray source is from intra-nucleus, and gamma ray source is from extra-nucleus.

C) From the quantum theory, electro-magnetic wave has wave-nature and particle-nature

D) The electro-magnetic radiation is in proportion to momentum.

E) The electro-magnetic wave has an electrical charge.

21. Which period is the highest radiation sensibility in the cell cycle?

A) S phase

B) M phase

C) Inter-phase

D) G1 phase

E) G2 phase

22. Which is the state that the radical as a by-product which is produced by the physical interaction of radiation interacts biological molecule?

A) Physical interaction stage

B) Chemical interaction stage

C) Biological interaction stage

D) Physical-chemistry interaction stage

23. Which is the correct explanation for Bergoni-Tribondeau's law?

A) The cell become more mature, more sensible for radiation.

B) The younger cells are insensible for radiation.

C) The low metabolic-rate cells are sensible for radiation.

D) The stem-cells or interstitial-cells are insensible for radiation.

E) The tissues that has frequent cell division or rapid growth are sensible for radiation.

24. Which is the correct answer for the specificity of the deterministic effect from radiation exposure?

A) The most symptom is expressed as chronicity.

B) It appears from the cell mutant.

C) The representative example is cancer and leucosis.

D) The symptom is ambiguous that it occurs from radiation.

E) The deterministic effect can be prevent when exposure dose preserves under threshold dose.

25. Which is the correct answer that an exposure dose of LD50/60 which the exposed person died in a few months as a blood forming function disorder caused by radiation exposure?

A) 1 ~ 2 Gy

B) 3 ~ 5 Gy

C) 6 ~ 8 Gy

D) 8 ~ 10 Gy

E) 0.75 ~ 1.25 Gy

26. What is the major phenomenon when exposure 200 mGy to the embryo in preimplantation period?

A) Malformation

B) Embryonic death

C) Decline in intelligence

D) Heritable defect

E) Congenital atrichia

27. What is the effect that little amount of radiation exposure expedite the physiological activity and beneficial effect?

A) Adjustment reaction

B) Spectator effect

C) Stochastic effect

D) Heredity instability

E) Radiation hormesis

28. What is the representative chronic disorder for the deterministic effect caused by radiation exposure?

A) Cancer

B) Leukemia

C) Cataract

D) Heredity defect

E) Inflammatory erythema

29. Which organ has the lowest radiation sensibility?

A) Spermatogonium

B) Intestinal epithelial cell

C) Matured lymphocyte

D) Cutaneous basal cell

E) Cerebral cortical cell

30. Which is most quickly effected when human is exposed by gamma ray?

A) Lymphocyte

B) Granulocyte

C) Hemoglobin

D) Platelet

E) Matured red blood cell

31. Which is the temporary sterilization dose for exposure on a genital gland?

A) 1 ~ 2 Gy

B) 2 ~ 4 Gy

C) 4 ~ 6 Gy

D) 6 ~ 8 Gy

E) 0.1 ~ 0.5 Gy

32. What nuclide causes the disorder in a bone with internal exposure?

A) H-3

B) C-14

C) I-131

D) Sr-90

E) Rn-222

33. Which is the correct dose that makes a natural mutant as twice?

A) 1 Gy

B) 5 Gy

C) 10 Gy

D) 20 Gy

E) 100 Gy

34. Which is the correct period that cause decline in intelligence of an embryo by radiation exposure?

A) Pre-natal period

B) Post-implantation period

C) Pre-implantation period

D) After delivery

E) Organogenic period

35. Which is the effect that the cell which can be die under normal condition restores when preserve a specific condition?

A) Dilution effect

B) Recombinational repair

C) SLD restoration

D) PLD restoration

E) Chemical protection effect

36. Which is the correct answer for the deterministic and stochastic effect?

A) For stochastic effect, a radiation exposure dose is in proportion to a severity.

B) For deterministic effect, a radiation exposure dose is not effected from a severity.

C) Deterministic effect cannot be perfectly prevent because of a natural occurrence probability.

D) There is a difference from a severity because of the difference of sensitivity of exposed person in the deterministic effect.

E) Since the deterministic effect has a threshold dose, if the dose is kept below the threshold dose, the incidence can be limited to acceptable level.

37. Which is the highest threshold value in deterministic effect? (The condition is limited 1 time exposure only)

A) Alopecia

B) Bone marrow death

C) Cataract

D) Erythema

E) Sterilization in the male

38. The radiation worker get alopecia, erythema, and blisters, but there is no symptom of ulcer caused by beta ray. How much exposure dose can be estimated?

A) 3 ~ 6 Gy

B) 7 ~ 8 Gy

C) Below 3 Gy

D) Over 20 Gy

E) 10 ~ 20 Gy

39. Which of following explanation for Hufet(Human Embryo and Fetus)?

A) Hypoplasia can be occurred in every pregnancy states.

B) Radiation exposure hardly effects Hufet.

C) Hufet has many cell divisions, so that is insensible in radiation.

D) For Hufet, focus on stochastic effects more than deterministic effects.

E) Embryo death mainly occurs by radiation exposure in organogenic period

40. Which is the correct explanation for genital and fetus exposure?

A) Sterilization is the result of cell mutant.

B) Because prenatal period is stable, radiation hardly effects a fetus.

C) There is no sense to decline an intelligence in a fetus from a radiation exposure.

D) The Embryo death is the result from a radiation exposure in an organogenic period.

E) In case of the malformation, it is from an exposure in organogenic period, but there is a possibility from parent's exposure.

41. Which unit is SI unit and considered with biological effect?

A) Bq

B) Gy

C) Sv

D) rem

E) J/kg

42. Which dose is the same unit as Kerma?

A) Exposure dose

B) Absorbed dose

C) Dose equivalent

D) Effective dose

E) Committed dose

43. If the substance of 1 kg is absorbed energy of 1 Joule, which is the correct value for the substance's absorbed dose?

A) 1 rad

B) 10 rad

C) 100 rad

D) 1,000 rad

E) 10,000 rad

44. Which is the correct answer for the unit of man-Sv in radiation protection?

A) Collective dose

B) Committed dose

C) Dose equivalent

D) Effective dose

E) Committed effective dose

45. Which is the correct explanation for the exposure dose?

A) The value of dose equivalent multiplied by tissue weighting factor

B) The dose when there is energy absorption of 1 J / 1 kg

C) The value of average absorbed dose multiplied by radiation weighting factor

D) The dose when there is energy absorption of 1 erg / 1 kg

E) Gamma ray or X-ray dose when it produce electronic charge of 2.58×10^{-4} Coulomb in air of 1 kg

46. What is the protection objective for the stochastic effect and deterministic effect?

A) Stochastic effect reduction – Deterministic effect reduction

B) Stochastic effect reduction – Deterministic effect protection

C) Stochastic effect protection – Deterministic effect reduction

D) Stochastic effect protection – Deterministic effect protection

E) Stochastic effect interception – Deterministic effect reduction

47. Which is the correct pair for the radiation hazard that does not have threshold dose?

A) Lung cancer and sterilization

B) Life shortening and skin cancer

C) Skin cancer and erythema

D) Cataract and decline in intelligence

E) Erythema and alopecia

48. Which is the right combination of the factors that effects a radiation hazard?

1. Deposited area in human body 2. Biological half-life 3. Radiation energy

4. Physical and chemical characteristic Nuclide 5. Dose rate and Dose distribution

A) 1, 2, 3

B) 2, 3, 4

C) 1, 3, 4

D) 2, 3, 4, 5

E) 1, 2, 3, 4, 5

49. Which is the dose limitation that recommended from ICRP60 and unescapable intervention for the prevention of accident expansion?

A) Effective dose 200 mSv, Skin dose equivalent 2 Sv

B) Effective dose 200 mSv, Skin dose equivalent 5 Sv

C) Effective dose 300 mSv, Skin dose equivalent 2 Sv

D) Effective dose 500 mSv, Skin dose equivalent 2 Sv

E) Effective dose 500 mSv, Skin dose equivalent 5 Sv

50. Which is the correct item to regards natural exposure as work radiation and include it in the dose limit?

A) Exposure of doctor and nurse

B) Exposure of patients in medical examination

C) Flight attendant

D) Fetus of pregnant radiation worker

E) Residents who lives on high mountain

51. Which is the most correct measurement method for internal deposited area among the external contamination measurement method?

A) Smear method

B) External measurement

C) Survey method

D) Bioassey method

E) Airborne radioactivity density measurement

52. What is the specificity in the bioassay method for the internal radioactivity contamination measurement?

A) The error of an internal exposure dose is small.

B) Correct internal contamination dose can be measure.

C) Internal radiation can be measured on the outside of human directly.

D) It can measure every nuclides including α and β ray emitter

E) Human needs a shower because distinct internal and external contamination before bioassay method.

53. Which is the correct characteristics for the stochastic effects in the radiation hazard?

A) It is occurred by acute and high exposed dose.

B) It is clear to a causal relationship in exposure and effect revelation.

C) It can be prevented when maintain the dose under the threshold value.

D) The severity of symptom is not related with exposure.

E) There are symptoms such as erythema, death and sterilization.

54. Which is the correct answer for the fundamental rules of radiation protection?

A) Justification of action, Optimization of protection, Dose limits

B) Justification of action, Dose limits, Prevention of deterministic effect

C) Optimization of protection, Dose limits, Prevention of deterministic effect

D) Dose limits, Prevention of deterministic effect, Minimization of stochastic effect

E) Justification of action, Prevention of deterministic effect, Minimization of stochastic effect

55. Which is the correct method for capture I-131 as air radioactive materials?

A) Cold trap

B) Paper fiber

C) Ion chamber

D) Filtration scavenging

E) active carbon cartridge

56. If the distance from radioactive source become 4 times long, what is the correct exposure dose at the same time?

A) 4 times

B) 8 times

C) 16 times

D) 1/4 times

E) 1/16 times

57. When alpha radioactive source is absorbed in the human body, what is the reason for giving the biggest exposure in human boy?

A) Alpha ray is charged particle.

B) Alpha ray has strong toxicity.

C) Alpha ray has positive charge.

D) Alpha ray is range and specific ionization

E) Exposure of alpha ray cannot be shield in principle.

58. When controlled a radioactive source using forceps or tong in radiation working, which category of radiation protection does it cover?

A) Reduce the working hours for an exposure reduction

B) Keep away from a radiation source

C) Reduce the density of the a radioactive source

D) Block the radioactive materials for an exposure reduction

D) Maintain a shielding state from the radioactive source

59. Which item is correct for 1st limitation (basic limitation)?

A) Authorized limit

B) ALI

C) DAC

D) Dose equivalent index

E) Effective dose limit

60. Which is the dose limit for the acute radiation workers who are committed to radiation accident site?

A) 0.5 mSv

B) 1 mSv

C) 5 mSv

D) 10 mSv

E) No limitation

61. What is the measurement principle for the semiconductor detector?

A) Track detection

B) Physical damage

C) Solid ionization

D) Fluorescence

E) Nuclear fission

62. What is the reason for cooling of semiconductor detector?

A) Prevention of damage from external impact

B) Prevention of thermal ionization from the normal temperature

C) Depletion layer expansion

D) Maintenance of high voltage

E) work function reduction

63. What is the semiconductor detector can be used on the normal temperature?

A) Ge(Li)

B) Si(Li)

C) HPGe

D) NaI(Tl)

E) CdTe

64. What is the scintillation substance which has a different character among scintillator?

A) Anthracene

B) CsI(Tl)

C) BGO

D) LiI(Eu)

E) CsI(Na)

65. What is the optimal detector for measure neutron among the following scintillator?

A) Anthracene

B) CsI(Tl)

C) BGO

D) LiI(Eu)

E) CsI(Na)

66. What is the detector using lowest applied voltage among the air ionization detector?

A) Proportional counter

B) GM counter

C) GaAs

D) LiI(Eu)

E) Ionization chamber

67. What is the time that the output pulse arrive counter's minimum selection level in GM counter?

A) Operating time

B) Dead time

C) Resolving time

D) Recovery time

E) Repetition time

68. What is the objective to add halogen or organic gas in GM counter?

A) Prevention of occurrence the electron avalanche from a negative ion

B) Exterior insulation

C) Prevention of occurrence the secondary electrons from a positive ion

D) Energy division of incidence radiation

E) Dead time reduction

69. What is the objective to add P-10 or BF3 gas in proportional counter?

A) Dead time reduction

B) Prevention of electron avalanche

C) Exterior insulation

D) Applied voltage maintenance

E) Secondary ionization amplification

70. Which is the correct answer for a common feature GM counter and proportional counter?

A) Applied voltage

B) Kind of extinction gas

C) Operating voltage

D) Principle of measurement

E) Energy division

71. Which is the correct measurement technique for the radioactive measurement?

A) Defined solid angle method

B) Liquid scintillation counting method

C) Coincidence counting method

D) 2π counting method

E) 4π counting method

72. What is the precondition for applying an exposure dose?

A) It is applied for every radiation.

B) The interactive targets for the light particle is always the material.

C) Outflow electron energy is always smaller than inflow electron energy

D) It needs a charged particle equilibrium

E) The energy of light particle must be over 3 MeV.

73. What is the basic measurement principle and SI unit for the absorbed dose?

A) C/kg, Moseley's law

B) J/kg, Bragg-Gray's cavity principle

C) rad, Bragg-Gray's cavity principle

D) Sv, Geiger-Nuttall rule

E) s-1, transient equilibrium and permanent equilibrium

74. When measuring α, β source simultaneously with a proportional counter, is it best to measure radiation at relatively low voltages?

A) Bremsstrahlung ray

B) Neither is measured.

C) Both are measured.

D) β ray

E) α ray

75. What is Γ ray scattering angle at which the energy of the Compton electron becomes maximum in the Γ ray energy spectrum?

A) 180 degrees

B) 140 degrees

C) 120 degrees

D) 65 degrees

E) 40 degrees

76. What is appropriate measuring instrument and height for the surface contamination measurement?

A) Ionization chamber, 1 m

B) Fancake GM, 1 cm

C) Fancake GM, 10 cm

D) Fancake GM, 5 cm

E) Proportional counter, 1 cm

77. What should be first thing to check when measuring radiation?

(Understand the safety and measurement conditions around the measuring point)

A) Correcting factor

B) Measuring time

C) Decontamination process

D) Statistical process

E) Whether the a measuring instrument is calibrated

78. Which is the correct explanation for Whole Body Count (WBC) method as internal exposure?

A) It is possible to be applied every nuclides such as alpha and beta emitter.

B) It does not need a correction because the machine is high price.

C) It indirectly estimates the internal radioactive dose estimation using measure excretions.

D) After wipe the nose with filter paper, and measure the radioactive dose on the filter paper

E) It can detect internal radioactive dose directly, and find nuclide deposited area to some degree.

79. What is the best condition for the good gamma ray spectrum?

A) Energy resolution is big.

B) Energy resolution is small.

C) The height of photoelectric peak is low.

D) The spread of photoelectric peak is big.

E) Compton continuous distribution field is big.

80. What is the advantage of the semiconductor detector?

A) Energy resolution is good.

B) Radiation damage is low.

C) Maintenance cost is low.

D) High radiation dose can be measured.

E) It is easy to make a product of broad effective counting area.