

放射線管理士測驗

Radiation Safety Manager

2024 年 8 月 24 日星期六

1. 除題意不清楚或是圖片有問題，禁止詢問與試題有關的問題。
2. 應答時禁止使用任何文件。
3. 請在電腦答案卡上圈選作答

項目	填寫內容
姓名	您的中文與英文姓名
試題名稱	RSM Test
項目	不用填寫
科目	不用填寫
受試者識別代碼	您的准考證號碼 24XXX 請填寫准考證後 5 碼，將您選定之數字的圓圈塗滿。
科目代碼	不用填寫
地點代碼	不用填寫
作答方式	本測驗共有 90 題問題。請使用 1 到 90 作答欄位。 請將測驗卷 Q1 的答案填入答案卷的答案選擇 1。Q2 = 答案選擇 2，Q3 = 答案選擇 3...Q90 = 答案選擇 90。

1. Which of the following is the most related with Bremsstrahlung?
 - A) α -ray
 - B) β -ray
 - C) γ -ray
 - D) Heavy ion
 - E) Neutron

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. What is called to be natural decreased radiation value in radiation source?
 - A) Contamination
 - B) Equilibrium
 - C) Decay
 - D) Absorption
 - E) Reflection

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-electron production
 - D) Photo-electric effect
 - E) Photonuclear reaction

17. There are two radioisotopes. : A (λ_A , N_A) and B (λ_B , N_B)

Which of the following is the correct equation for transient radiation equilibrium?

A) $\lambda_A N_B = \lambda_B N_A$

B) $T_A N_A = T_B N_B$

C) $\lambda_A N_A = T_B N_B$

D) $\lambda_A N_A = \lambda_B N_B$

E) $T_A N_A = T_A N_B$

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 range of specific binding energy when it has bigger than 15 mass number?
- A) 1 ~ 3 MeV
 - B) 3 ~ 5 MeV
 - C) 5 ~ 6 MeV
 - D) 7 ~ 8 MeV
 - E) 8 ~ 10 MeV

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. Choose the correct combination.

- A) BGO scintillation – β ray
- B) NaI(Tl) scintillation – γ ray
- C) LiI(Eu) scintillation – γ ray
- D) Liquid scintillation counter(LSC) – α ray
- E) ZnS(Ag) scintillation – low energy β ray

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. What is the most important peak in the analysis of radioisotope at gamma ray?

- A) Photo peak
- B) Single escape peak
- C) Double escape peak
- D) Backscatter
- E) Compton edge

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) Bioassay 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 body?

- 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) Pancake GM, 1 cm
- C) Pancake GM, 10 cm
- D) Pancake 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. What is the applying dose when calibrating radiation counter?

- A) Absorbed dose
- B) Exposure dose
- C) Effective dose
- D) Equivalent dose
- E) Committed dose

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.

81. According to the Safety Standards for Radiation Protection in Taiwan, the facility director should ensure that the effective radiation equivalent dose to the general public does not exceed how many millisieverts per year?

- A) 1.
- B) 2
- C) 3
- D) 2.5
- E) 2.2

82. According to the Safety Standards for Ionizing Radiation Protection in Taiwan, the total activity of C-14 in wastewater discharged into sewers should not exceed how many becquerels per year?

- A) 3.7×10^{15}
- B) 1.85×10^{13}
- C) 3.7×10^{10}
- D) 1.85×10^3

83. Under the Ionizing Radiation Protection Act in Taiwan, which of the following does not require government approval or authorization?

- A) A radiation protection plan developed by the facility.
- B) Permission for persons over 16 and under 18 years old to participate in radiation work for the purpose of teaching or job training.
- C) Quality assurance program for medical exposures established by the facility operator.
- D) Addition of radioactive material to products not exceeding 1 mSv.

84. Which of the following is considered as exposure from radiation work?

- A) Medical exposure
- B) Occupational exposure
- C) Emergency exposure
- D) Group exposure

85. According to the regulations in Taiwan, the number of training hours per year for each radiation worker should be at least X, and the training records should be kept for at least Y years. What are the X and Y?

- A) 3 and 5
- B) 6 and 5
- C) 6 and 10
- D) 3 and 10

86. According to the regulations in Taiwan, how many years after graduation is the minimum qualification for a Radiation Protection Continuing Education Lecturer?

- A) 3
- B) 5
- C) 10
- D) 2

87. According to the regulations in Taiwan, employers should keep records of occupational irradiation of radiation workers for at least X years, or how old are they Y. What are X and Y?

- A) 20, 65
- B) 30, 65
- C) 20, 75
- D) 30, 75

88. According to the regulations in Taiwan, the effective dose for a person over sixteen and under eighteen years of age who is being taught or trained to work with radiation shall not exceed X millisieverts (mSv); the equivalent dose to the crystalline body of the eye shall not exceed Y mSv; and the equivalent dose to the skin or limbs shall not exceed Z mSv; the X and Y and Z shall be respectively?

- A) 6, 50, 150
- B) 10, 30, 150
- C) 6, 30, 100
- D) 10, 20, 100

89. What is the single accidental radiation dose (in millisieverts) received by a radiation worker above which the employer should provide immediate intensive medical care?

- A) 20
- B) 30
- C) 40
- D) 50

90. What is the minimum number of years that records of radioactive waste gas or wastewater discharges from nuclear facilities should be kept?

- A) 1 year
- B) 3 years
- C) 5 years
- D) 10 years