Kingdom of Saudi Arabia

Ministry of Education

Umm Al-Qura University

College of Applied Sciences

Final exam:1st semester 1439-1440H
Program: MMP
Course Name: Medical Radiation Physics (1)
Course Code: 4033285
Exam Time: Two   Hr(s)
Exam Date: 16 / 4 /1440H
Number of Papers: [4] papers

0Student's Name: Student ID: Group No.: 1

Please answer Four questions only: (two questions from Part A and two question from Part B)

أجب عن أربعة أسئلة فقط (سؤالين **(اجبارى)** من الجزأ (أ) **وسؤالين (اختيارى)** من الجزء (ب)

Total Exam Marks: 50

Part A : Please answer thr following two questions. (اجبارى)
Question One   *[14 Marks]*

1-Choose the Correct Answer
  1. Tc-99m source has half life 6 hrs and its initial activity at certain
      moment is 100 MBq then the final activity after 24 hrs is
a. 6.25 MBq
c. 12.5 MBq
d. 50   MBq
e. 25 MBq

2. Isobaric transition: Given the atomic number of parent nucleus is Z , that of the daughter nucleus is
………. , if a beta particle is emitted or …….., If a positron is emitted . The atomic mass number of the daughter is same as that of the
parent.
a. Z+1 , Z-1
b. Z-1 Z+1
c. Z-2, z-1
d. z+1, Z-2

3. Alpha particle is a highly energetic Helium Nucleus that is emitted from the nucleus of the radioactive
   isotope when the
a. neutron to proton ratio is too low
b. neutron to proton ratio is too high
c. Proton to neutron ratio low
d. Proton to neutron ratio is too high

4.One of the interactions of radiation with matter related to diagnostic radiology
a. Photoelectric effect
b. Compton scattering
c. Pair production
d. All of the above

5. The atomic number of anode of X-ray tube is   ----   and the melting point of it
   is about -----
a. 74 and 3400 ^{0}C
b. 82 and 4000 ^{0}C

c. 13 and 5000 ^{0}C

d. 82 and 3400 ^{0}C

6- Percentage of a given amount of radium , will decay during a period of 1000 years, decay rate constant equals 4.38 x 10^{-4} $^-$yr to be

a. 67%

b. 23 %

c. 33 %

d. 25 %

7. The probability of photoelectric absorption is proportional to

a. Z^3/E

b. Z^2/E^3

c. Z/E

d. Z/E^2

___

8. Atoms that having nuclei with the same number of protons but different number of neutrons called.

a. Isotopes

b. Isomer

c. Isobar

d. Isotonic

9. 0.5 Ci is equivalent to :

a. 1.85 x 10^{12} Bq

b. 1.85 x 10^4 MBq

c. 1.85 x 10^5 MBq

d. 1.85 x 10^6 kBq

10. Indirect measurements of entrance skin dose to patients is calculating using the following equation:

a.ESD = O/P X (kV/80)^2 x mAs (100/FSD)^2 X BSF

b. ESD = O/P X (kV/80)^2 x mAs (100/FSD)^2

c. ESD = O/P X (kV/80)^2 x(100/FSD)^2 X BSF

d. ESD = O/P X (kV/80)^2 x mAs (100/FSD)^2 X BSF x Field size

11. Alpha emission: Z number of Daughter nuclides decrease by …….and atomic mass number decrease by ……compared of parent nuclides.

a.Two , four

b.Four , two

c.Two, two

d.Zero , four

12.--------is defined as to the difference between the maximum energy and the energy of certain beta particle

a. a neutrino
b. photelectric phenomena
c. Compton scattering effect
d. pair production

13. Tc-99m is preferred to use in some nuclear medicine imaging instead I-31.
a. because Tc-99m emits gamma and beta radiation
b. to prevent absorption of beta energy in skin
c.I-31 emits gamma energy only
d. because Tc-99m emits gamma energy only .

14. The energy of ---------- is equal to the difference in energy between
    the x-ray energy and L shell energy (E_{EK}-E_L).
a. Auger electron
b. Excitation
c. Ionization
d. Ionization

Question Two   *[6 Marks]*

2.1. Discuss with drawing the Alpha absorption curve , define and deduce range of

   alpha particle.

2.2 Calculate and compare between radiation risk resulted from shielding of beta source

   using Al and lead thickness.

Part 2 : Please answer two questions only
Question Three   *[15 Marks]*

Mark true (√) or wrong (x) and correct the false

1-The energy of ejected photoelectron is equal to the difference
   in energy between the gamma ray photon emitted by the radioisotope and   the   •
   binding energy of the electron.   •
2- the density of   a sheet of Al, 1 cm thick is 2.7 g/cm3, so the density thickness of   ·
   aluminium is 2.7 g/cm^3 ·
3. the minimum possible atomic number materials are used for gamma shielding.   •
4. the thickness of lead (pb) to reduce the fluence rate of a beam of 0.5 MeV gamma rays   •
to 10% of its initial intensity is 3.1 cm
5. 80 mCi equivalent to 2.96 MBq
6. Nucleus consists of two main parts; the protons and neutrons and called hydron
7. $^{226}_{88}$ Ra transformed by alpha emission to an excited state of Rn-222 then emits 0.186 MeV .

8. The unit of absorbed dose is defined as the joule per kilogram J/Kg, termed the Rad

9. the annual dose limit for workers are 1mSv and for public is 20 mSv

10. Delta rays are defined as it is a beta particles travel a long distance and are easily deflected during collision and follow tortuous paths as they pass through absorbing media

Question Four   [15 Marks]

4.1 Discuss the radiation quantities and units

4.2 The dose rates outside the shielding of a cyclotron are found to be 4 µGy/h for gammas , 3 µGy/h for thermal neutrons, and 2 µGy/h for fast neutrons with energies greater than 2 MeV . What is the equivalent dose rate of the combined radiations according to ICRP values for W_R? WR for gamma = 1 , for thermal neutrons = 5 and fast neutrons = 10

Question Five   [15 Marks]

5.1. Explain the X-ray production with drawing.

5.2. Discuss with drawing the phenomena of photoelectric effect and its relation to diagnostic radiology

5.3 State and deduce the decay law of radionuclides