**University of Salahaddin Radiation Dosimetry Fourth year**

**College of Science Final-Examination Time: 3 hours**

**Physics Department Date: 2017-2018**

Q1/ Choose the correct answer for the following (20 marks)

**Note: Each question carries one mark .**

1- \_\_\_\_\_\_\_\_\_\_\_\_ deposits energy in the medium through direct coulomb interactions.

 a. x-rays b. gamma-rays c. beta ray d. neutrons ray

2- the \_\_\_\_\_\_\_\_\_\_\_ is chemical identity of the element.

 a. atomic number b. mass number c. chemical symbol d. neutron number

3- \_\_\_\_\_\_\_\_\_\_influencing nuclides stability.

 a. atomic mass b. Magic numbers c. odd numbers of nucleons d. all of them

4- When the neutron to proton ratio is too high, \_\_\_\_\_\_\_\_\_\_ occur .

 a. Beta plus decay b. Beta Minus decay c. Alpha decay d. Electron Capture

5- Coulomb force interaction of the charged particle with orbital electron for b >> a (soft collision).

 a. b << a b. b >> a c. b ≈ a d. Not Given

6- \_\_\_\_\_\_\_\_\_\_\_\_ results from charged particle Coulomb interaction with the nuclei of the absorber.

 a. Radiative stopping power b. Collision stopping power

 c. Total stopping power d. hard collision

7- The interactions with nuclei may be direct photon-nucleus interactions, which called\_\_\_\_\_\_\_\_\_\_.

 a. pair production b. Compton effect

 c. photodisintegration d. triplet production

8- The unit of energy fluence is\_\_\_\_\_\_\_\_\_\_\_\_.

 a J.m b. J.m2  c. J.m-2 d. Not Given

9-\_\_\_\_\_\_\_\_\_ is the absolute value of the total charge of the ions of one sign produced in air when all the electrons and positrons liberated or created by photons in mass.

 a. dose b. dose rate c. exposure d. exposure rate

10- The density of energy deposition in a material such as tissue is called the \_\_\_\_\_\_\_\_\_\_\_.

 a. LET b. RBE c. DRC d. DF

11- When radiation interacts with water, the water is ionized, producing\_\_\_\_\_\_\_\_\_\_\_.

 a. OH- b. OH+  c. HOH+ d. HOH-

12- the \_\_\_\_\_\_\_\_\_\_ cells were one of the most sensitive cells to radiation due to their rapid regeneration rate.

 a. Skin b. Brain c. Muscle d. Not Given

13- Slight blood changes may be detected by medical evaluations, when the dose equal \_\_\_\_\_\_\_\_\_.

 a. 1 rad b. 10 rad c. 100 rad d. 150 rad

14- How long can a radiation worker stay in a 1.5 rem/hr radiation field if we wish to limit his dose to 200 mrem.

 a. 0.8 minutes b. 8 minutes c. 0.45minutes d. 4.5 minutes

15- The constant ALI must not deliver a committed effective dose equivalent of more than \_\_\_\_\_\_\_\_\_ rem per year to any individual organ or tissue.

 a. 0.5 rem b. 5 rem c. 50 rem d. 500 rem

16- The \_\_\_\_\_\_\_can be reset by heating it to a high temperature to release all trapped electrons, a process known as annealing.

a. TLD phosphor b. Semiconductor Detector c. Scintillation Detectors d. Not Given

17- X-Ray produced when electrons with kinetic energies between \_\_\_\_\_and \_\_\_\_\_\_are decelerated in special metallic targets.

a. 10 keV, 50 keV b. 10 MeV, 50 MeV c. 10 keV, 50 MeV d. Not Given

18- X rays produced by electrons with kinetic energies between 10 keV and 100 keV are called \_\_\_\_\_\_\_\_\_\_\_X rays.

 a. orthovoltage b. superficial c. megavoltage d. Not Given

19- Various parameters are used as X ray beam quality indices :

 a. HVL b. NAP c. photon spectrum d. All of them

20- 6.45x10-5  C/kg is equal to\_\_\_\_\_\_\_\_\_.

a.2 Roentgen b. 0.5 Roentgen c. 0.75 Roentgen d. Not Given

Q2/The diagram below shows the energy deposited in a small volume (V). The energy losses are shown by lines. (8 marks)

1. What are the interactions at points A,B and C ?
2. Energy transferred
3. Net Energy transferred
4. Energy imparted

A

B

C

$$hν\_{1}=5 Mev$$

$$hν\_{2}=0.4 Mev$$

$$0.511 Mev$$

$$0.511 Mev$$

Q3/A: Draw typical thin and thick target bremsstrahlung spectra originating from 100 keV electrons striking a thin and thick target. (4 marks)

B:Compute the total and primary charge pairs created per cm in a mixture of 90% argon and 10% carbon dioxide by using the table below: (4 marks)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Gas | W-values (ev/pair) | stopping power(keV/cm) | np(ip/cm) | nt(ip/cm) |
| Ar | 26 | 2.44 | 29 | 94 |
| CO2 | 33 | 3.01 | 34 | 91 |

Q4/ Write the equation of the following and define all parameters. (9 marks)

1-The energy transferred to the orbital electron from the heavy charged particle for a single interaction*.*

2- Compton wavelength shift relationship.

3-the application of cavity theory to ionization chamber calibration and dosimetry protocols.

Q5/A: write the factors which are considered in calculating Annual Limits on Intake and Derived Air Concentrations: (5 marks)

B: a-you are using 50 mCi of Co-6o.what is the exposure rate 2 feet from the source?  at 1m for 1 mCi (5 marks)

C: What is the (Kc)air in Gy at appoint in air where X= 47 R ($\frac{W\_{air}}{e}=33.97 J/C)$ ?

 (5 marks)