

Questions Bank, Chapter One & Two

on Environmental Radiation 2023-2024

Q1/ One Curie is equal to:

- a) the square root of the binding energy
- b) the energy of an alpha-particle
- c) 3.7×10^{10} disintegrations per second
- d) mc^2

Q2/ When an atom undergoes beta decay, the atomic number of the nucleus:

- a) is unchanged
- b) increases by one
- c) decreases by one
- d) none of the above

Q3/ The binding energy of a nucleus is defined as one of the following.

Is this definition:

- a) the energy equivalent to its mass
- b) the mass difference between its neutrons and protons
- c) the energy needed to remove a neutron from the nucleus
- d) the difference between the mass of the nucleus and the sum of the masses of its protons and neutrons

Q4/ What process produces most of the energy that is radiated by the Sun?

a) gravitational contraction, b) chemical combustion, c) nuclear fusion, d) nuclear fission

Q5/ Of the following, the most energetic form of non-ionizing radiation is:

a) ultra-violet light

b) infra-red light

c) radar

d) microwaves

Q6/ Most of what we call background radiation comes from two sources. One is the naturally radioactive elements around us. What is the other source?

Q7/ Which of the following three nuclear radiations is the most penetrating?

a) alpha

b) beta

c) gamma

Q8/ List three purposes of using radioactivity and how it is used?

Q10/ Explain why the presence of radon gas in buildings is a health hazard.

Q11/ The radioactive isotope used has a half-life of 5.3 years. Explain what is meant by the term half-life.

Q13/ Who discovered radioactivity?

A. Marie Curie.

B. Albert Einstein.

C. Henri Becquerel

Q14/ Which of the following is stopped by a sheet of paper?

- A. Alpha particle.
- B. Beta particle.
- C. Gamma ray.

Q15/ Matching: Choose the letter of the correct word for each of the questions

below. Each letter will be used only once.

A. Decay series, **B.** Half-life, **C.** Helium, **D.** Longer, **E.** Nuclear fission, **F.** Radioactive pollution, **G.** Radioactivity, **H.** Packing Fraction, **I.** Gamma emission, **J.** Life time

_____ 1) The amount of time for half the atoms in a radioactive sample to decay.

2) The more stable a nucleus is, the _____ its half-life.

_____ 3) The process in which the nucleus of an unstable atom releases radiation in order to become stable.

_____ 4) Occurs by de-excitation of a high excitation level of the nucleus to the ground state.

_____ 5) The splitting of an atom into 2 smaller nuclei (nuclear power plant).

6) An alpha particle is actually a nucleus of

_____ 7) The name given to the several steps required to get a radioactive element to a stable element.

- _____ 8) As a measure of the stability of a nucleus, equal to the difference between its mass in amu and its mass number, divided by the mass number.
- 9) This means that after a period corresponding to theof a radioactive nucleus the initial abundance has decreased to 36.8% of its initial value, of a nucleus can be found
- 10) If the level of the radioactive radiations increases above a certain limit it causes harmful effects to living beings. This harmful level of radiations emitted by radioactive elements is called

Q16/ Where does radioactive radon gas come from?

Q17/ What is radioactive half-life?

Q18/ Name those forms of radiation that ionize and that do not.

Q19/ Which form of radiation is used for food preservation?

Q20/ When unstable nuclei undergo radioactive decay, they emit three types of radioactivity. Which is not one of them?

Alpha, beta, gamma, X-ray.

Q21/ Radioactivity is spontaneous and random.

True False

Q22/ Which type of radioactive decay doesn't change the atomic number?

Alpha, beta, gamma, all forms of radioactive decay affect the atomic number.

Q23/ Particles that are helium nuclei are called:

alpha particles, beta particles, gamma particles, there are no particles that are helium nuclei.

Q24/Radioactivity that takes the form of high energy electromagnetic waves

would be: alpha , beta , gamma , zeta .

Q25/ Isotopes of an element have different numbers of:

Protons, neutrons, electrons.

Q26/ What is the SI base unit for the rate of radioactive decay?

Q27/ Calculate the binding energy per nucleon for potassium-40. Nuclear

mass of potassium-40 = 39.953548 u Mass of one neutron = 1.008 665 u

Mass of one proton = 1.007 276 u .

Q28/Radium-226 has a half-life of 1620 years. Show that its decay constant is

about $1.4 \times 10^{-11} \text{ s}^{-1}$. 1 year = $3.15 \times 10^7 \text{ s}$.

Q29/ Gamma rays can be used to treat cancer and are produced by which

radioactive material?

Q31/ How do radioactive materials enter the food chain?

Q32/ Ionisation smoke detectors contain a small amount of the radioactive isotope

americium. ^{241}Am is an α -emitter. It has a half-life of 432 years, and the

activity from the source in a new smoke detector is about $3.5 \times 10^4 \text{ Bq}$. Explain

why the radiation produced by a smoke detector does not pose a health hazard.

Q33/ In β^- decay a neutron within the nucleus gets transformed into a proton

in accordance with the relation

Q34/ The atomic mass of $^{16}_8\text{O}$ is 15.99494amu. Find: (a) Its binding energy and (b) Its binding

energy per nucleon?

Q35/ Half life of radium (${}_{88}\text{Ra}^{226}$) is 1620 years. What is the activity of 2gram of radium?

(a) 3.6×10^{10} Bq (b) 7.2×10^{10} Bq (c) 1.44×10^{11} Bq (d) 2.88×10^{11} Bq (e) 5.76×10^{11} Bq

Q36/ Which of the following isotopes is good for radioactive dating

(a) ${}^{238}\text{U}$, (b) ${}^{12}\text{C}$, (c) ${}^{14}\text{C}$.

Q37/ The half life of technetium-99 is 6 hours. What fraction of a sample is left after

(a) 6 hours, (b) 2 days

Q38/ X-rays are photons (i.e. electromagnetic radiation) with energies typically above 1 keV. They were discovered by in

Q39/ Marie Curie discovered and

Q40/ The process by which X-ray photons are absorbed depends on the and

Q41/ The range of beta particle is considerably greater than an alpha particle.

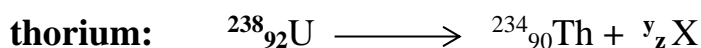
True fail

Q42/ Living organisms are continuously exposed to a variety of radiations called background radiations. True fail

Q43/ There are two sources of radiation pollution, namely natural sources and anthropogenic (man- made) sources. True fail

Q44/ Radioisotopes used in industry to ,..... ,..... .

Q45/ The following nuclear equation represents the decay of uranium to



- (a) Determine the values of y and z
- (b) Identify the particle X

(c) The thorium also decays by emission forming an isotope of palladium ($^{234}_{91}\text{Pa}$). Write the nuclear equation for this decay.

Q46/ A sample of uranium-238 contains 2.50×10^{23} atoms. Given that the

half-life of uranium-238 is 1.42×10^{19} seconds, find

(a) the decay constant, λ ;

(b) the initial activity of the sample, in Becquerel.

Q47/ Matching: Choose the letter of the correct word for each of the questions

below. Each letter will be used only once.

A-Cesium-137, **B-** Cobalt-60, **C-** Iridium-192, **D-** Hydrogen-3 **E-** Iodine-131, **F-** Plutonium-239, **G-** Strontium-90, **H-** Radon-222, **I-**Technetium-99m, **J-** Americium-241

1- -----used for Food Irradiator.

2- -----Used for Nuclear Weapon.

3- -----used for Cancer Therapy.

4-----used in Industrial Radiography

5-----used for Eye Therapy Device

6- -----used for Exit Signs

7- -----used for Therapy .

8-----used for Imaging

9-----used for Environmental.

10- -----Smoke Detectors

48) The amount of radioactive isotopes found in the human body (70 kg adult) are:

Isotopes	Amount of radioactivity in Bq
Carbon-14	-----
Polonium- 210	-----
Potassium-40	-----
Radium-266	-----
Thorium	----- 7
Tritium	-----
Uranium	-----

49/ 1 atomic mass unit (u) is equal to

- A. 1.660×10^{-27} kg
- B. 2×10^{-27} kg
- C. 3×10^{-27} kg
- D. 5×10^{-27} kg

50/ Time taken by a radioactive substance to decay half is called

- A. time delay
- B. half life
- C. time constant
- D. half period

51/ What disease can be caused by the radiation from isotopes?

- Influenza
- Malaria
- Smallpox
- Cancer
- Bubonic Plague

52/ What are some of the common units of measure for quantifying a unit of radiation dose?

53/The abbreviation “mrem” indicates:

- millirem, a unit of dose equivalent
- millirad, a unit of dose
- milliroentgen, a unit of exposure

54/The largest man-made source of background radiation is from:

smoke detectors.

televisions.

nuclear fallout.

medical uses (x-rays, nuclear medicine, radiation oncology, etc.).

55/ who is given credit for the discovery of X-ray? Henri Becquerel, Wilhelm Roentgen, Marie Curie, Pierre Curie

56/ Who is given credit for the discovery of radioactive materials? Henri Becquerel, Wilhelm Roentgen, Marie Curie, Pierre Curie

57/ X-ray generators produce radiation through: Bremsstrahlung processes, K-shell emission processes, Radioactive decay, Both A and B

58/ X-rays and Gamma rays have significant penetrating power due to their: Short wavelength, Medium wavelength, Long- wavelength, Wide range of wavelengths

59// Most of the radioactive elements found in nature are members of four radioactive series -----, -----, -----, and ----- . The final daughter for each series is -----, -----, -----, -----

60/Explain how ^{14}C is generated and incorporated into living things.

61/ Give the equation which expresses the Radioactive Decay Law, and explain the meaning of each of its terms.

62/ Define each of the following: Half life, Decay Constant, Becquerel.

63/ Define each of the following radiation units: Roentgen; Becquerel; Gray; Seivert.

64/A sample of radioactive substance is found to have an activity of 100 kBq. Its radioactivity is measured again 82 days later and is found to be 15 kBq. Calculate:

- the half-life;
- the decay constant.

65/ What is the difference between X-rays and gamma rays?

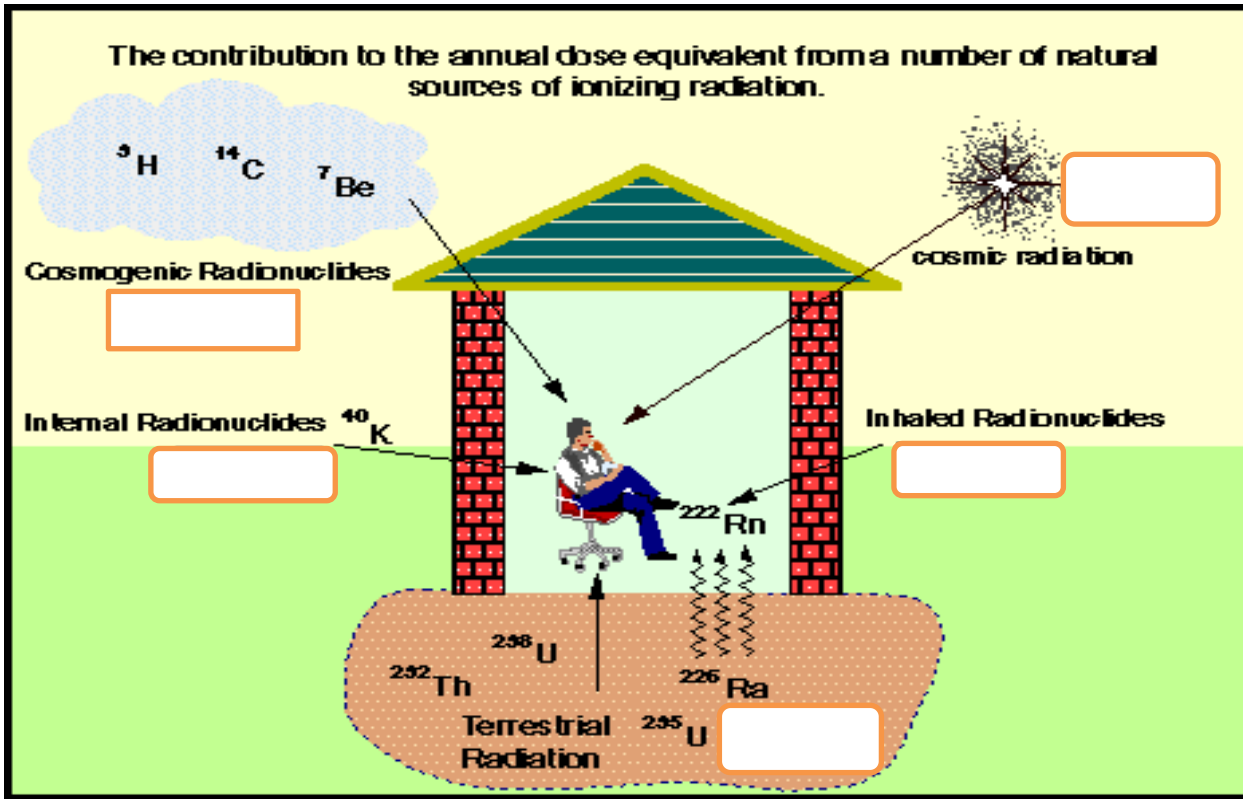
- a. X-rays are produced extra-nuclearly whereas gamma rays are produced in nuclear decays.
- b. X-rays have higher energies than gamma rays.
- c. gamma rays are produced by bremsstrahlung.
- d. X-rays and gamma rays interact with matter differently.

Q66/ Which photon processes are dominant in the context of diagnostic radiology?

- a. Compton scattering and photoelectric effect.
- b. Photoelectric effect and pair production.
- c. Compton scattering and pair production.
- d. Compton and Rayleigh scattering.

Q67/ Point on all parts in the following:






- a-The contribution to the annual dose equivalent from a number of natural sources of ionizing radiation.



b- Potassium-40 content of certain foods







Radiation from Natural Sources

	Source		mrem/year
	Cosmic rays	<input style="width: 50px; height: 20px;" type="text"/>	28
	The Earth	<input style="width: 50px; height: 20px;" type="text"/>	26
	Radiation from food	<input style="width: 50px; height: 20px;" type="text"/>	200
	The human body	<input style="width: 50px; height: 20px;" type="text"/>	25
	Buildings	<input style="width: 50px; height: 20px;" type="text"/>	4

Transparency 4-1

Radiation from Manmade Sources

	Source		mrem/year
	Medical	<input style="width: 50px; height: 20px;" type="text"/>	
	Fallout	<input style="width: 50px; height: 20px;" type="text"/>	
	Consumer products	<input style="width: 50px; height: 20px;" type="text"/>	
	Nuclear power	<input style="width: 50px; height: 20px;" type="text"/>	

Q68/ Write three applications of radioisotopes in industry.

Q69/ Write three applications of radioisotopes in medicine.

Q70/ They are electromagnetic waves incapable of producing ions while passing through matter, due to their -----.

Q71/ Red radiation color is emitted when the electron "falls" from orbit at $n=-----$ to orbit with $n=-----$.

Q72/ Any object which has a temperature above absolute zero radiates -----.

Q73/ Seven foods you should never Microwave ----- , -----, -----, -----
--- ,-----, -----, ----- .

Q78/ The amount of Potassium-40 found in the human body (70 kg adult) is a bout

- a) 3,700Bq , b) 4,000Bq , c) 23Bq .

Q79/ The rad may be described as a) disintegrations per second, b)ions produced in air, c)energy deposited in an absorber, d) biologic effects .

Q80/ Which form of radioisotopes is used for food preservation?

- a) Cesium-137 (1.5×10^6 Ci) , b) Iridium-192 (100 Ci) , c) Americium-241(5×10^{-6} Ci)

Q81/ Like gamma rays ,X-rays, radio waves, radar, radiant heat, laser and visible light are forms of electromagnetic radiation. They have the same ----- but different ----- .

Q82/ Radiation from natural sources are classified in five groups -----, -----, -----, -----, and -----
- .

Q83/ Radiation from man-made sources are classified in four categories -----, ----- , -----
,and-----.

Q84/ Write the quantity of potassium radioactivity in Bq per 500 grams for the following certain foods:.



Banana Red meat Lima beans White potatoes carrot Brazil nuts

Q85/ Which of the following is NOT an example of non-ionizing radiation?

- (a) Ultraviolet , (b) X-ray, (c)Microwave, (d) Visible light

Q86/ Which of the non-ionization radiations is more dangerous for human body ,explain briefly?

Q87/ Compare between the direct and indirect action of radiation?

Q88/ Gamma rays can be used to treat cancer and are produced by which radioactive material?

Q89/ What does the usage of the follow radionuclides:

1- Cesium-137 , Cobalt-60, Plutonium-239, Technetium-99m, Americium-241.

Q90/ A photoelectric interaction occurs between an 8 keV photon and a K shell electron.
A 3.6 keV photoelectron is emitted. The binding energy of the K shell is _____ keV.

a. 3.6 , b. 4.0 , c. 4.4 , d. 8.0 , e. 11.6 .

Q91/ Explain why the presence of radon gas in buildings is a health hazard.

Q92/ Write the health effects of the following non ionizing radiations :

Infrared, Ultraviolet (UV), Microwaves

Q93/ Write the frequency range of the following radiations:

X-Ray, Gamma Ray, Infrared, Ultraviolet (UV), Microwaves

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