Text 1: Radioactivity

Paragraph1 **Concepts of Radioactivity:** This section introduces some of the basic concepts of radioactivity. It is designed to provide the general reader with an overall understanding of the radiological sections of this report.
A discussion of the analyses used to qualitatively quantify radioactive material, the common sources of radioactivity in the environment, and how they contribute to an individual's radiation dose are provided. Some general statistical concepts are also presented, along with a discussion of radionuclides of environmental interest at BNL.

Paragraph 2 **Radioactivity:** The atom is the basic constituent of all matter and is one of the smallest units into which matter can be divided. Each atom is composed of a tiny central core of particles, or nucleus, surrounded by a cloud of negatively charged particles called electrons. Most atoms in the physical world are stable, meaning that they are not radioactive. However, some atoms possess excess energy, which causes them to be physically unstable. In order to become stable, an atom rids itself of this extra energy by casting it off in the form of charged particles or electromagnetic waves, known as radiation.

Paragraph 3 **Common types of radiation:** The three most important types of radiation are described below:
Alpha: An alpha particle is identical in makeup to the nucleus of a helium atom, consisting of two neutrons and two protons. Alpha particles have a positive charge and have little or no penetrating power in matter. They are easily stopped by materials such as paper and have a range in air of only an inch or so. Naturally occurring radioactive elements such as uranium and radon daughters emit alpha radiation.
Beta: Beta radiation is composed of particles that are identical to electrons. As a result, beta particles have a negative charge. Beta radiation is slightly more penetrating than alpha but may be stopped by materials such as aluminium foil and Lucite panels. They have a range in air of several feet. Naturally occurring radioactive elements such as potassium- 40 (K-40) emit beta radiation.
Gamma: Gamma radiation is a form of electromagnetic radiation, like radio waves or visible light, but with a much shorter wavelength. It is more penetrating than alpha or beta radiation, capable of passing through dense materials such as concrete. X-rays are similar to gamma radiation.

Paragraph 4 **Nomenclature**: Throughout this report, radioactive elements (also called radionuclides) are referred to by a name followed by a number, e.g., cesium-137. The number following the name of the element is called the mass of the element and is equl to the total number of particles contained in the nucleus of the atom. Another way to specify the identity of cesium-137 is by writing it as Cs-137, where 'Cs' is the chemical symbol for cesium as it appears in the standard Periodic Table of the Elements. This type of abbreviation is used in the text and many of the data tables in this report.

Paragraph 5 **Dose units***:* The amount of energy that radiation deposits in body tissues or organs, when corrected for human risk factors, is referred to as dose equivalent or, more generally, as dose. Radiation doses are measured in units of rem. Since the rem is a fairly large unit, it is convenient to express most doses in terms of millirem (1,000 mrem = 1 rem). To give a sense of the size and importance of a 1 mrem dose, Figure B-1 indicates the number of mrem received by an individual in one year from natural and background sources. These values represent typical values for residents of the United States. Note that the alternate unit of dose measurement commonly used internationally and increasingly in the United States is the sievert, abbreviated Sv. One Sv is equivalent to 100 rem. Likewise, 1 millisievert (mSv) is equivalent to 100 mrem.

Paragraph 6

Sources of radiation

Radioactivity and radiation are part of the earth's natural environment. Human beings are exposed to radiation from a variety of common sources, the most significant of which are listed below.

Cosmic: Cosmic radiation primarily consists of charged particles that originate in space, beyond the Earth's atmosphere. This includes radiation from the sun and secondary radiation generated by the entry of charged particles into the Earth's atmosphere at high speeds and energies. Radioactive elements such as hydrogen-3 (tritium), beryllium-7, carbon-14, and sodium-22 are produced in the atmosphere by cosmic radiation. The average dose from cosmic radiation to a person living in the United States is about 26 mrem per year.

Terrestrial: Terrestrial radiation is released by radioactive elements present in the soil since the formation of the Earth about five billion years ago. Common radioactive elements contributing to terrestrial exposure include isotopes of potassium, thorium, actinium, and uranium. The average dose from terrestrial radiation to a person living in the United States is about 28 mrem per year.

Internal: Internal exposure occurs when radionuclides are ingested, inhaled, or absorbed through the skin. Radioactive material may be incorporated into food through the uptake of terrestrial radionuclides by plant roots. Human ingestion of radionuclides can occur when contaminated plant matter or animals that consume contaminated plant matter are eaten. Most exposure to inhaled radioactive material results from breathing the decay products of naturally occurring radon gas. The average dose from eating foods to a person living in the United States is about 40 mrem per year; the average dose from radon product inhalation is about 200 mrem per year.

Medical: Millions of people every year undergo medical procedures that utilize radiation. Such procedures include chest and dental x-rays, mammography, thallium heart stress tests, and tumour irradiation therapies. The average dose from nuclear medicine and x-ray examination procedures in the United States is about 14 and 39 mrem per year, respectively.

Anthropogenic: Sources of anthropogenic (man-made) radiation include consumer products such as static eliminators (containing polonium-210), smoke detectors (containing americium-241), cardiac pacemakers (containing plutonium-238), fertilizers (containing isotopes of the uranium and thorium decay series), and tobacco products (containing polonium-210 and lead-210). The average dose from consumer products to a person living in the United States is 10 mrem per year (excluding tobacco contributions).

Paragraph 3	**Exercise 1**: Match a word in column A with a definition in column B
Column A	Column B
Gamma	An alpha particle is identical in makeup to the nucleus of a helium atom, consisting of two neutrons and two protons. Alpha particles have a positive charge and have little or no penetrating power in matter. They are easily stopped by materials such as paper and have a range in air of only an inch or so. Naturally occurring radioactive elements such as uranium and radon daughters emit alpha radiation.
Alpha	Beta radiation is composed of particles that are identical to electrons. As a result, beta particles have a negative charge. Beta radiation is slightly more penetrating than alpha but may be stopped by materials such as aluminium foil and Lucite panels. They have a range in air of several feet. Naturally occurring radioactive elements such as potassium- 40 (K-40) emit beta radiation.
Beta	Gamma radiation is a form of electromagnetic radiation, like radio waves or visible light, but with a much shorter wavelength. It is more penetrating than alpha or beta radiation, capable of passing through dense materials such as concrete. X-rays are similar to gamma radiation.

Paragraph 6	**Exercise 2:** Match a word in column A with a definition in column B
Column A	Column B
Medical	Internal exposure occurs when radionuclides are ingested, inhaled, or absorbed through the skin. Radioactive material may be incorporated into food through the uptake of terrestrial radionuclides by plant roots. Human ingestion of radionuclides can occur when contaminated plant matter or animals that consume contaminated plant matter are eaten. Most exposure to inhaled radioactive material results from breathing the decay products of naturally occurring radon gas. The average dose from eating foods to a person living in the United States is about 40 mrem per year; the average dose from radon product inhalation is about 200 mrem per year.
Anthropogenic	Cosmic radiation primarily consists of charged particles that originate in space, beyond the Earth's atmosphere. This includes radiation from the sun and secondary radiation generated by the entry of charged particles into the Earth's atmosphere at high speeds and energies. Radioactive elements such as hydrogen-3 (tritium), beryllium-7, carbon-14, and sodium-22 are produced in the atmosphere by cosmic radiation. The average dose from cosmic radiation to a person living in the United States is about 26 mrem per year.
Cosmic	Terrestrial radiation is released by radioactive elements present in the soil since the formation of the Earth about five billion years ago. Common radioactive elements contributing to terrestrial exposure include isotopes of potassium, thorium, actinium, and uranium. The average dose from terrestrial radiation to a person living in the United States is about 28 mrem per year.
Internal	Sources of anthropogenic (man-made) radiation include consumer products such as static eliminators (containing polonium-210), smoke detectors (containing americium-241), cardiac pacemakers (containing plutonium-238), fertilizers (containing isotopes of the uranium and thorium decay series), and tobacco products (containing polonium-210 and lead-210). The average dose from consumer products to a person living in the United States is 10 mrem per year (excluding tobacco contributions).
Terrestrial	Millions of people every year undergo medical procedures that utilize radiation. Such procedures include chest and dental x-rays, mammography, thallium heart stress tests, and tumour irradiation therapies. The average dose from nuclear medicine and x-ray examination procedures in the United States is about 14 and 39 mrem per year, respectively.

	N°	**Exercise 3**: Determine if the following statements are true or false.	True	False
Paragraph 2	1	In order to become unstable, an atom rids itself of this extra energy		
	2	electrons are positively charged particles		
	3	Most atoms in the physical world are stable, meaning that they are not radioactive		
	4	The atom is not the basic constituent of all matter		
	5	Some atoms possess excess electricity, which causes them to be physically unstable		
	6	The proton is the basic constituent of all matter		
	7	Protons are negatively charged particles		
	8	In order to become stable, an electron rids itself of this extra energy		
	9	The atom is the basic constituent of all matter		
	10	Most atoms in the chemical world are stable, meaning that they are not radioactive		
	11	In order to become stable, an atom rids itself of this extra energy		
	12	The atom is one of the biggest units into which matter can be divided		
	13	Some electrons possess excess energy, which causes them to be physically unstable		
	14	The atom is one of the smallest units into which matter can be multiplied		
	15	Electrons are negatively charged particles		
	16	The atom is one of the smallest units into which matter can be divided		
	17	Most atoms in the physical world are stable, meaning that they are not radioactive		
	18	Some atoms possess excess energy, which causes them to be physically unstable		
Paragraph 6	19	Cosmic radiation primarily consists of charged particles that originate in space, beyond the Moon’s atmosphere		
	20	External exposure occurs when radionuclides are ingested, inhaled, or absorbed through the skin		
	21	Billions of people every year undergo medical procedures that utilize radiation		
	22	Terrestrial radiation is released by radioactive elements present in the sea		
	23	Hundreds of people every year undergo medical procedures that utilize radiation		
	24	Internal exposure occurs when radionuclides are ingested, inhaled, or absorbed through the mouth		
	25	Terrestrial radiation is released by radioactive elements present in the air		
	26	Cosmic radiation secondly consists of charged particles that originate in space, beyond the Earth’s atmosphere		
	27	Millions of people every year undergo medical procedures that utilize radiation		
	28	Cosmic radiation primarily consists of charged particles that originate in space, beyond the Earth’s atmosphere		
	29	Terrestrial radiation is released by radioactive elements present in the soil		
	30	Internal exposure occurs when radionuclides are ingested, inhaled, or absorbed through the skin		

radiation	atmosphere	utilize	radionuclides	physical	nucleus	protons
physically	electromagnetic	alpha	procedures	X-rays	radioactive	space
rem	electrons	love	which	identical	smallest	helium

Exercise 4

Fill in the blanks with an appropriate word from the box.
The first letter is given.

N°	Sentence
1	The atom is the basic constituent of all matter and is one of the **s** _ _ _ _ _ _ _ units into **w** _ _ _ _ matter can be divided.
2	Radiation doses are measured in units of **r** _ _
3	**X** - _ _ _ _ are similar to gamma radiation.
4	In order to become stable, an atom rids itself of this extra energy by casting it off in the form of charged particles or **e** _ _ _ _ _ _ _ _ _ _ _ _ _ _ waves, known as **r** _ _ _ _ _ _ _ _
5	Millions of people every year undergo medical **p** _ _ _ _ _ _ _ _ _ that **u** _ _ _ _ _ _ radiation _ _ _ _
6	Cosmic radiation primarily consists of charged particles that originate in **s** _ _ _ _ , beyond the Earth's **a** _ _ _ _ _ _ _ _ _

7	An **a** particle is identical in makeup to the nucleus of a **h** atom, consisting of two neutrons and two **p**
8	Each atom is composed of a tiny central core of particles, or **n**, surrounded by a cloud of negatively charged particles called e
9	Beta radiation is composed of particles that are **i** to electrons.
10	Most atoms in the **p** world are stable, meaning that they are not radioactive.
11	Throughout this report, **r** elements (also called **r** are referred to by a name followed by a number.
12	However, some atoms possess excess energy, which causes them to be **p** unstable.

Terminology

Terminology	مصطلحات	Terminologie	Terminology	مصطلحات	Terminologie
Radioactivity			Wavelength		
Atom			Increasingly		
Nucleus			Statistical concepts		
Electron			Electromagnetic waves		
Radiation			Radio waves		
Neutron			Visible light		
Proton			Periodic Table of the Elements		
Aluminium			Qualitatively		
Core					

Exercise 5: Match a word in column A with a definition in column B

	N°	Column A		Column B
	1	Radioactivity	A	harmful radiation that is sent out when the nuclei of atoms are broken up
	2	Atom	B	the smallest particle of a chemical element that can exist
	3	Nucleus	C	the part of an atom that contains most of its mass and that carries a positive electric charge
	4	Electron	D	a very small piece of matter with a negative electric charge, found in all atoms
	5	Radiation	E	powerful and very dangerous rays that are sent out from radioactive substances
	6	Neutron	F	a very small piece of matter that carries no electric charge and that form a part of the nucleus of an atom
	7	Proton	G	a very small piece of matter with a positive electric charge that forms part of the nucleus of an atom
	8	Aluminium	H	a chemical element. Aluminium is a light, silver-grey metal for making pans, etc..
	9	Wavelength	I	the distance between two similar points of a wave of energy, such as light or sound
	10	Potassium	J	a chemical element. Potassium is a soft silver-white metal that exists mainly in compounds which are used in industry and farming
	11	Radon	K	a chemical element. Radon is a radioactive gas used in the treatment of disease such as cancer
	12	X-ray	L	a type of radiation that can pass through objects that are not transparent and make it possible to see inside or through them

Irregular verbs

Base form	Past simple	Past participle	Base form	Past simple	Past participle	Base form	Past simple	Past participle
Arise			Bend			Bring		
Awake			Bind			Build		
Be			Bite			Burn		
Bear			Bleed			Buy		
Beat			Blow					
Become			Break					
Begin			Breed					

Comparative-superlative

Paragraph 2

Adjective	Comparative	Superlative
Small		
Tiny		
Stable		

Paragraph 3

Adjective	Comparative	Superlative
Important		
Short		

Phrasal verbs for travel

Phrasal verb (multiword verb) = verb + preposition
Prepositions: in, up, on, over, away, of, down, toward…

N°	Phrasal verb	Meaning	Example
1	Drop off		
2	See off		
3	Take off		
4	Get in		
5	Check in (at…)		
6	Check out (of…)		
7	Set out		
8	Pick up		

Idioms about science and technology

'Idiom: a group of words whose meaning is different from the meanings of the individual words'

Idiom	Meaning	Example
o Be on the same wavelength o Be on someone's wavelength	To have the same way of thinking or the same ideas or feelings as somebody else	o We work together but we aren't really on the same wavelength. o My boss and I are just not on the same wavelength.

Exercise 6

Translation - Traduction - ترجمة
Paragraph 2: Radioactivity
Paragraphe 2 : La radioactivité
الفقرة الثانية: النشاط الاشعاعي