

## 4 RADIATION – BALANCED VIEW

### 1. Warm-up: What myths about radiation do people believe in?

### 2. What type of radiation is / isn't harmful?

*alpha particles    beta particles    microwaves    sunlight    UV rays    X-rays    gamma rays*

**Compare with the discussion among American students.** <https://www.youtube.com/watch?v=wQmnztyXwVA>

Before listening, check that you understand the phrases:

0-3.35

*dirty word*

*ruin tissues*

*exposed to great amounts*

*cancer tumours*

*seep through concrete walls*

*too much of a coincidence*

### 3. Read the first part of the article and complete the right forms of the missing words.

1. TREAT

4. INTEGRATION

7. DURATION

2. SEQUENCE

5. MEASURE

8. WEAKEN

3. SPONTANEITY

6. CANCER

9. CONSTITUTION

The atomic nucleus and its properties have an important impact on our society. The nucleus is involved with archaeological dating, diagnosis and **1**\_\_\_\_\_ of cancer and other diseases, chemical analysis, radiation damage and nuclear bombs, the generation of electricity by nuclear energy and the **2**\_\_\_\_\_ disposal of nuclear waste, the formation of new elements, the shining of the Sun and other stars, and even the operation of common household smoke detectors.

A specific type of nucleus, such as  $^{238}\text{U}$  or  $^{14}\text{C}$ , is referred to as nuclide. Nuclides whose nuclei undergo spontaneous decay are called radionuclides. The **3**\_\_\_\_\_ process of nuclei undergoing a change by emitting particles or rays is called radioactive decay or radioactivity. Radioactive nuclei can **4**\_\_\_\_\_ in three common ways: alpha decay, beta decay and gamma decay.

Radionuclides have many uses in medicine, chemistry, biology, agriculture, and industry. For example, a radioactive isotope of iodine  $^{123}\text{I}$ , is used in a diagnostic **5**\_\_\_\_\_ of the thyroid gland. The patient is administered a prescribed amount, which is absorbed by the thyroid gland. This allows doctors to trace it as it is released into the bloodstream in the form of protein-bound iodine. Nuclear radiation also can be used to treat diseased cells. Focusing an intense beam of radiation from cobalt- 60 on a **6**\_\_\_\_\_ tumour destroys its cells and thus impairs or halts its growth.

In chemistry and biology, radioactive "tracers" such as  $^{14}\text{C}$  (radiocarbon) and  $^3\text{H}$  (tritium) are used to tag an atom in a certain part of a molecule so that it can be followed through a series of reactions. In this way, the reaction pathways of hormones, drugs, and other substances can be determined. In industry, tracer radionuclides help manufacturers test the **7**\_\_\_\_\_ of mechanical components and identify **8**\_\_\_\_\_ in equipment. In environmental studies, small amounts of radionuclides help detect groundwater movement through soil and trace the paths of industrial air and water pollutants.

Neutron activation analysis is one of the most sensitive analytical methods in science. A beam of neutrons irradiates the sample, and each **9**\_\_\_\_\_ element forms a specific radionuclide that can be identified by the characteristic energies of the gamma rays it emits. Neutron activation analysis can be used to identify and measure 50 different elements in amounts as small as one picogram ( $10^{-12}$  g).

#### 4. Smoke detector

Do you know how radiation can be utilized in smoke detectors? Study the pictures below and describe the three parts of the process:



<https://www.youtube.com/watch?v=pcn7MDpoZrY> 1.52 – 3.00 (-3.30 including health concerns)

Listen to the explanation and complete one word for each gap.

1. Radiation from substances that can free electrons is called ..... radiation.
2. The detectors contain a small amount of americium-241 closed in a .....
3. Between the oppositely charged metal plate there is a small .....
4. Ions are produced when the alpha particles ..... with the air.
5. In contact with smoke, ions are restored to ..... state.
6. The alarm is triggered when electrical current is .....
7. .... detectors are a less common type of smoke detectors.
8. The small amount of alpha radiation in the detector is practically .....
9. It can be dangerous only if the particles are .....
10. This can result in lung ..... damage.

#### 5. GRAMMAR - Adding emphasis to arguments

Can you find one/two of the sentences from 1 – 10 above which have more emphasis than the others?

You can use several grammar means to put more stress (emphasis) to your arguments:

Comparative or superlative adjectives: *much longer...*

Quantifiers: *many, all*

Determiners: *such*

Adverbs: *even, especially, enough, still*

Modal verb: *must*

6. Read the second part of the article. Which paragraph contains emphasized sentences?

- Notice the use of infinitive structures with *enough* and put the two phrases where they belong in the text.

*is energetic enough to knock*

*has enough hydrogen to produce*

In the next two sections, we will discuss the controlled and uncontrolled release of nuclear energy. Fission is the process in which a large nucleus is split into two intermediate-size nuclei, with the emission of neutrons and the conversion of mass into energy. A bomb is an example of uncontrolled fission. A nuclear reactor is an example of controlled fission, in which we control the growth of the chain with reaction and the release of energy. The first commercial fission reactor for generating electricity went into operation in 1957 at Shippingsport, Pennsylvania.

Fusion is the process in which smaller nuclei combine to form larger ones, with the release of energy. It is the source of energy of the Sun and other stars. About 600 million tons of hydrogen are converted to 596 million tons of helium every second. The other 4 million tons of matter are converted into energy. Fortunately, the Sun A..... energy at its present rate for several billion more years.

Radioactivity has been around far longer than humans, as a natural part of the environment. Still, we must be aware of the dangers associated with radiation. Radiation that B..... electrons out of atoms or molecules and form ions is classified as ionizing radiation. Alpha particles, beta particles, neutrons, gamma rays and X-rays all fall into this category. Such radiation can damage or even kill living cells, and it is particularly harmful when it affects protein and DNA molecules involved in cell reproduction. Ionizing radiation is especially dangerous because you cannot see, smell, taste, or feel it.

Sources of natural radiation involve cosmic rays from outer space, radionuclides in the rocks and minerals in our environment. Human made sources include X-rays and radionuclides used in medical procedures, fallout from nuclear testing, nuclear wastes, and emissions from power plants. Ironically, because fossil fuels contain traces of uranium and thorium and their daughters, more radioactivity is released into the atmosphere from power plants burning coal and oil than from nuclear power plants.

## 6. Interview with an expert

- What do these two people have in common: Wilhelm Rontgen, Dana Drábová?
- Work in pairs, one of you is a journalist and the other one is a renowned radiologist. Prepare an interview for general public in which you will provide a balanced view on the topic of radiation and dispel some common fears or myths.
- Have a look at the phrases below. Use some of them to present arguments for or against nuclear radiation. Also, use some of the words / structures for adding emphasis to your arguments.

### **To introduce points/arguments for or against:**

One (very convincing) point/argument in favour of... / against... is that...

It could be argued that....

It is often claimed/suggested that...

It is widely argued/generally felt/believed/held/maintained that....

Some/many/most people/experts/scientist/skeptics/critics claim/suggest/argue/feel/agree/hold that...  
advocate (+ing/noun)/support the view that...

### **To make contrasting points:**

on the other hand, however, still, yet, but, nonetheless, nevertheless, even so,  
it may be said/argued/claimed that,...

others/many people oppose this viewpoint/strongly disagree..., claim/feel/believe this argument is  
incorrect/misguided

although, though, even though, while, whilst, whereas, despite/in spite of (the fact that), regardless of  
the fact that

Opponents of ... argue/believe/claim that...

While/Although ..., it cannot be denied that...

### **Conclusion expressing balanced considerations/opinion indirectly**

In conclusion,

..... it can be said/claimed that ...

All things considered,

..... it seems/appears that...

Taking everything into account/consideration,

..... it is likely/unlikely/possible/foreseeable that ...

To conclude,

..... there is no/little doubt that...

To sum up,

..... it is true to say that ...

Finally/Lastly,

..... it may be concluded/said that ...

## **7. Say these expressions with the right pronunciation:**

nucleus    archaeological    diagnosis    analysis    spontaneous    decay    determined    constituent

### **Links for practising grammar**

Relative pronouns who, whom, whose

[https://www.englishpage.com/minitutorials/who\\_whom\\_1.htm](https://www.englishpage.com/minitutorials/who_whom_1.htm)

enough, too

<https://www.grammar-quizzes.com/infinitive3b.html>

### Sources:

Shipman, J. and J. Wilson, A. Todd (2006) *An Introduction to Physical Science* Houghton Mifflin Company

<http://academicwriting.wikidot.com/for-and-against-essays>