Study pack: Life after Fukushima

Chapter 2 – My life in Fukushima

Learning objectives

English	
2.7	Pupils take notes for their own use when reading and listening to texts based on purposeful information processing and communication.
Modern languages	
2.5.1	The students convey the content of texts using purposeful communication.
2.8.1	The pupils summarise verbal texts in writing or orally using purposeful information processing and communication.
Mathematics, sciences, technology, STEM	
6.10	Pupils use concepts relating to radiation and electricity to explain phenomena and their applications found in everyday life.
6.25	Pupils use concepts relating to nuclear physics to describe radioactive phenomena and their applications.
6.36	Pupils use measurement values, quantities and units in mathematical, scientific, technological, and STEM contexts.
6.43	Pupils explore the interaction between STEM disciplines and between STEM disciplines and society on the basis of specific societal challenges.
Learning competencies	
13.3	Pupils optimise search strategies based on the usefulness and reliability of digital and non-digital sources to answer a question asking for information.
13.4	Pupils use explanatory and exploratory summaries to retrieve information from a digital and non-digital resource.
13.7	Pupils use study skills strategically in order to fully understand the content of teaching material.

Expected duration

40 minutes

Materials/media

- Part 2 Prezi presentation/website: My life after Fukushima
- Workbook Part 2: My life after Fukushima
- Online quizzes:
  - Review of course material on radioactivity (7 questions): https://forms.gle/J7H5jF2zURgU7TYN8
  - Introduction to radioactivity (5 questions): https://forms.gle/a2bLMJukNtVeVFTb7
- Clip about radiation protection (Vimeo): https://vimeo.com/531825298/e6dbcc41bc (2:33)
- YouTube: short clip of a cloud chamber: https://www.youtube.com/watch?v=_lrRn--Og1g (0:48)

Method

This section introduces pupils to the concepts of radioactivity and the impact of a nuclear disaster on Masako's daily life.

1.1 Radioactivity

After pupils have read a brief introduction about the effects, they will gauge their knowledge of radioactivity. Depending on their previous knowledge, the pupils are guided to the section that is appropriate to that level of knowledge.

Pupils with prior knowledge of radioactivity can test their knowledge with a quiz. The quiz can be found in the students' workbooks (part 2) or can be accessed via the following link: https://forms.gle/J7H5jF2zURgU7TYN8. The quiz consists of 7 questions and is marked out of 20. The quiz takes about 5 minutes. Pupils will have the opportunity to go over the answers once the quiz is submitted. If pupils are unsure of the answers, they can look for them in the text extracts provided in the teaching materials (Prezi presentation or PDF) or using the video that can be viewed via this link**:** https://vimeo.com/531825298/e6dbcc41bc. A transcript of the video can be found in the appendix.

Pupils who have little or no previous knowledge will follow a different track. Illustrations and short text extracts will enable them to familiarise themselves with the terms atoms, ionising radiation, and radioactivity, the types of radiation, and how to protect yourself against the various types of radiation and internal and external exposure.
In that section, a video clip has been added that shows radiation from uranium in a cloud chamber. A cloud chamber is a structure consisting of a box, alcohol, dry ice, and a radioactive source, among other components. It is used to make radioactivity visible to the naked eye.

Tip: you can also build a cloud chamber yourself to make cosmic rays visible. You can find out how to do this via this link: https://www.natuurkunde.nl/artikelen/2432/subatomaire-deeltjes-zien.

Pupils can go through the information on their own, but they can also go through it together in class. This is followed by a brief evaluation in the form of an online quiz consisting of five questions, which is marked out of 15. The students can take the quiz at this link: https://forms.gle/a2bLMJukNtVeVFTb7. The quiz can also be made in the workbook (part 2).

1.2 Decontamination of Fukushima town

After the nuclear accident, the Japanese government drew up a detailed plan to decontaminate the affected areas in order to limit the exposure of the Japanese population to radioactive particles originating from the Fukushima nuclear power plant. In the worst affected areas, such as Ōkuma, the central government assumes this responsibility, but in other areas, such as Aizu-Wakamatsu or Fukushima town, the local authority becomes involved. The local authority is responsible for the preparing and carrying out decontamination works.

The section 'Decontamination of Fukushima town' explores that decontamination process in more detail. During these works, not only were public areas thoroughly cleaned, but also private properties such as houses and gardens.

The waste produced by these works is stored in temporary storage areas. In Fukushima town, you can find such storage sites in the town, next to houses, on playgrounds, on former car parks, but also, for example, in parks in the mountains surrounding the town. Fukushima town has started to empty the temporary storage sites and move the waste to another temporary storage site located in the worst affected areas around the nuclear power plant. Waste prompts societal questions, such as where to store waste, how best to store it, and so on. You can invite students in the class to explore these issues in more detail and hold a discussion.

The final part of this section is a game provided on the website and in the presentation. In this game, students have to find and point out temporary storage sites (covered by a green tarpaulin) in a residential area in Fukushima town. This game helps students to understand how Japan deals with radioactive waste and how it is part of everyday life.

1.3 My life after Fukushima

This section consists of two parts: one that examines the measurement of radioactivity in more detail and the monitoring the Japanese population in the affected areas; and one on the impact on daily life.

The first part gives a brief overview of how radioactivity is monitored in Fukushima Prefecture. Examples of this include measuring stations in the streets and the systematic screening of children and young people for thyroid cancer.

The second part discusses some examples and precautions that Masako and her family take to reduce exposure to radioactivity. The examples examine food products and the living environment.

Based on the information given in this section and the previous section on decontamination, you can hold a class discussion with pupils about the impact of a nuclear disaster.

Part 2:

My life after Fukushima

Contents:

1. Radioactivity? I know all about it!

Test your knowledge of radioactivity! Answer the seven questions and then go over the answers. How many points can you get?

1. What is a radionuclide? Choose the correct definition.

	Atoms with an unstable nucleus emitting radiation in the form of waves
	Atoms with an unstable nucleus emitting radiation in the form of particles
X	Atoms with an unstable nucleus emitting radiation in the form of particles or waves

2. What types of ionising radiation exist?

X	Alpha radiation
	Microwave radiation
X	Gamma radiation
X	X-rays
X	Neutron radiation
	Light
X	Beta radiation

3. Choose the statements that are correct.

X	The half-life is the time after which exactly half of the original quantity of a substance remains.
	The half-life can vary from a few milliseconds to several minutes.
	Radionuclides cannot split spontaneously.
X	Alpha radiation is the easiest type to block.

4. What do the following units express? (Some units have multiple options)

	Activity	Dose equivalent	Collective effective dose	Absorbed dose	Effective dose
Becquerel	X				
Gray				X	
Sievert		X			X
Man-sievert			X		

5. Which type of ionising radiation is easiest to block?

Alpha radiation

6. Indicate the three basic principles of radiation protection.

X	Time
X	Protective screens
	Measuring ionising radiation
	The material of the protective screening
X	Distance
	Protective clothing

7. Are the following statements true or false?

	True	False
Children and babies are more sensitive to ionising radiation than adults.	X	
You can only become contaminated externally by radionuclides.		X
Some parts of the body are more sensitive to ionising radiation than others.	X	

2. Radioactivity: what's that?!

Answer the five questions and then go over the answers. How many points can you get?

1. Is ionising radiation visible?

	Yes
X	No

2. Indicate whether the following statements about ionising radiation are true or false.

	True	False
Ionising radiation comes from radionuclides.	**X**	
All atoms are radionuclides.		**X**
Radionuclides emit enough energy to affect other atoms.	**X**	
Ionising radiation cannot damage DNA, the blueprint of our body.		**X**
Ionising radiation is visible.		**X**

3. Which of the following types of radiation are ionising?

	Light
X	Alpha radiation
	Microwave radiation
X	Gamma radiation
X	Beta radiation

4. Indicate which measure gives you sufficient protection against alpha radiation.

	A thick lead sheet
	An aluminium sheet
X	Maintaining a distance of 10 cm
	One metre of concrete

5. Indicate what precautions you can take to protect your body from ionising radiation.

X	Shielding yourself from radiation
X	Moving away from the radioactive source
	Moving the radioactive source
	Measuring the source up close