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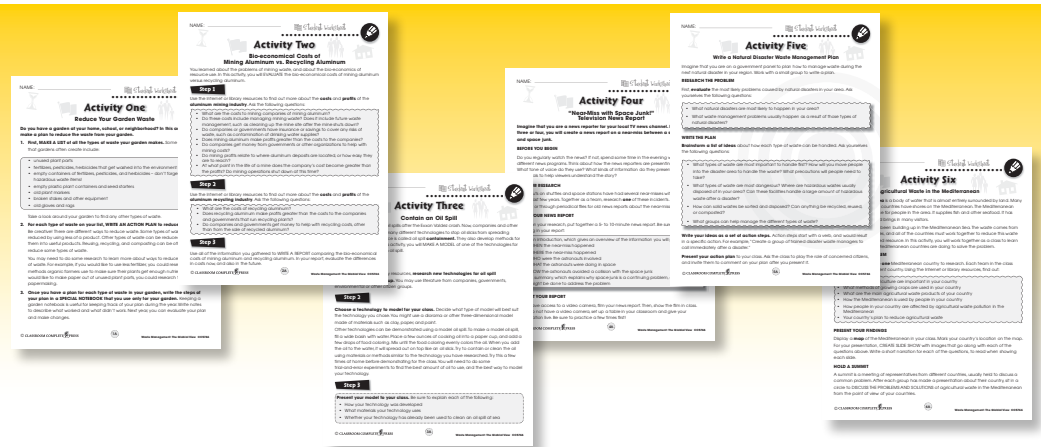
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# Radioactive Waste



1. Have you ever heard the word **radioactive**? What do you think the meaning of this word might be?

\_\_\_\_\_

\_\_\_\_\_

2. Use a dictionary to look up the word **NUCLEAR**. Write the definition on the lines below. The definition of **nuclear** is:

\_\_\_\_\_

\_\_\_\_\_

3. Fill in each blank with the correct term from the list below. You may use a dictionary to help you.

- |                    |                     |                    |          |
|--------------------|---------------------|--------------------|----------|
| X-rays<br>landfill | CAT-scan<br>barrier | syringe<br>uranium | fuel rod |
|--------------------|---------------------|--------------------|----------|

- a) A \_\_\_\_\_ is a place where waste is buried.
- b) \_\_\_\_\_ are used to see if you have a broken bone.
- c) A \_\_\_\_\_ places medicine into the body.
- d) Radioactive material used in a nuclear power plant is contained in a \_\_\_\_\_.
- e) A \_\_\_\_\_ can make a picture of organs and tissues inside the body.
- f) \_\_\_\_\_ ore is used as a source of radioactive materials.
- g) A \_\_\_\_\_ stops things from going in or out.



# Radioactive Waste

**What are radioactive materials?**

**Y**ou may have learned that all matter is made from tiny particles called **atoms**. The center of an atom is called a **nucleus** (plural *nuclei*). The nucleus contains even tinier particles. In some **radioactive** substances, the nuclei break down and release particles. The particles contain large amounts of energy, and can harm the tissues of living things.



People use radioactive materials for many different purposes. In medicine, radioactive materials are used in equipment for seeing inside the body, such as X-rays and CAT-scans. Radioactive substances are also used to treat cancers. Radioactive substances are also used to produce large amounts of energy in nuclear power plants. This energy is used to make electricity to power cities and towns.

**Describe the meaning of the term *radioactive*.**

STOP

\_\_\_\_\_

\_\_\_\_\_

**What is radioactive waste?**

Radioactive waste comes from three main sources. First, radioactive minerals must be mined from the earth. These materials include ores such as **uranium**. Some of the leftover materials from the mining can be radioactive. Second, waste is made when radioactive substances are used in medicine and industry. The substances themselves can become waste after they are used. Materials that come into contact with radioactivity can also become radioactive. These materials are called *low-level* radioactive waste, and include things like hospital sheets, gloves, and syringes. The third source of radioactive waste is the radioactive **fuel rods** used in nuclear power plants. After a fuel rod is used for a period of time, it does not produce enough energy to make it useful for making electricity. However, the fuel rod is still very radioactive. Waste fuel rods are called *high-level* radioactive waste.



# Radioactive Waste



1. **Circle** the word **True** if the statement is true. **Circle** the word **False** if it is false.

- a) Radioactive substances are used in hospitals.  
True      False
- b) Hospital gloves that have touched radioactive substances must be handled as radioactive waste.  
True      False
- c) Uranium ore is high-level radioactive waste.  
True      False
- d) Radioactive substances can be used in power plants to make electricity.  
True      False
- e) High-level radioactive waste must be disposed of in a landfill.  
True      False
- f) Over 300,000 people had to be moved after the Chernobyl nuclear power plant exploded.  
True      False
- g) Radioactive substances can cause cancer.  
True      False

2. On the lines below, describe **four** ways that people use radioactive substances.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. **Circle** the examples of high-level radioactive waste.

- used fuel rods      old X-ray machines      syringes used for cancer treatment
- fallout from a nuclear explosion      wastewater from a uranium mine
- uranium ore      hospital gowns used for CAT-scan patients

# Radioactive Waste

4. Explain the difference between **low-level** radioactive waste and **high-level** radioactive waste.

\_\_\_\_\_

\_\_\_\_\_

5. Explain why **disposing** of high-level radioactive waste causes so many problems.

\_\_\_\_\_

\_\_\_\_\_

## Extension & Application

6. Nuclear power plants were once thought to be a good source of electricity, because they do not create any air pollution. However, disposing of fuel rods has become such a big problem, that many people think nuclear power plants are no longer a good solution.

**Learn more about the problems of disposing of fuel rods in your country.** Use the Internet and library resources to find answers to the following questions.

- Are there nuclear power plants in your country?
- How are the used fuel rods disposed of now?
- Does your country have any plans for permanent fuel rod disposal sites?
- What are the problems that your country faces in finding permanent fuel rod disposal sites?
- How do citizens in your country feel about planned fuel rod disposal sites?
- What are the problems in transporting used fuel rods from nuclear power plants to the disposal sites?
- What are the problems with protecting fuel rod disposal sites?

Now, **WRITE AN OPINION PAPER** about nuclear energy and fuel rod disposal. In an opinion paper, you state your **opinions** and ideas, and support them with **facts**. The introduction of the paper should outline the facts of used fuel rod disposal, the problems your country faces, and any plans your country has to solve these problems. Then, in the body of the paper, state your opinion about the best way your country can dispose of nuclear fuel rods. Support your opinions with evidence from your research. Finally, give a short summary of the issues, and of your opinion about whether nuclear energy is a good solution for providing electricity to growing societies.

# Waste Management Success Story Documentary

In this activity, you will work in a small group to create a documentary about a group of people that has come up with creative ways to solve waste management problems.

**First**, use the Internet or library resources to research communities that have been successful at greatly reducing the waste that they produce. The community you choose might have the goal of **zero waste**. Once you find a community to report on, ask the following questions:

- What was the waste management problem that the community had to begin with?
- How did people come together to make a plan to address the problem?
- What steps did people take first?
- Did people learn to do different things with their waste?
- Did people build new facilities?

Gather any information about the waste management program that you can find.

**Second**, watch a few documentaries to become familiar with the style. Think about how they are narrated, and how images are used to help the viewer understand the topic.

**Third**, write and produce a documentary about your community. Write the narration in a clear, descriptive style, and be sure the narrative covers all of the questions above. Plan how you will use images while the narrator is speaking. If possible, try to contact a representative from the community you researched. Ask the representative if you could tape them talking about their community, or if you could use some written quotes in your documentary.

**Fourth**, using a video camera, tape your documentary. You may want to start and stop the tape each time you change images. You can even record the narration separately and edit the tape together.

**Finally**, show your documentary in class!

# Word Search

Find all of the words in the Word Search. Words are written horizontally, vertically, diagonally, and some are even written backwards.

habitat	acid	fuel rods	hazardous
reduce	fertilizer	disposable	Exxon Valdez
nuclear	recycle	profits	biogas
mining	landfill	debris	industries
fungicide	cyanide	Chernobyl	atom
reuse	sustainable	Kovalam	toxic
uranium	space junk	economics	rock

A	D	S	D	F	G	H	J	K	L	R	Z	D	X	C	R	V	R
Z	S	F	E	R	T	I	L	I	Z	E	R	E	G	C	V	O	Q
A	D	U	A	A	Q	S	O	Q	A	D	A	B	Q	A	C	S	W
S	I	N	S	S	W	D	P	W	S	D	S	R	W	K	Q	P	E
D	S	G	S	T	E	F	U	E	D	C	D	I	E	C	W	A	R
F	P	I	D	D	A	G	R	R	R	E	U	S	E	H	E	C	T
G	O	C	F	F	R	I	A	L	F	Z	F	Q	T	E	R	E	Y
H	S	I	G	G	R	H	N	T	A	X	G	W	Y	R	T	J	U
J	A	D	H	P	E	C	I	A	G	N	H	E	U	N	Y	U	I
K	B	E	J	R	C	Y	U	B	C	D	R	I	O	U	N	O	
I	L	A	K	O	Y	A	M	U	H	L	J	F	O	B	I	K	P
N	E	S	L	F	C	N	A	N	J	V	E	T	I	Y	O	Q	A
D	H	D	P	L	I	S	U	K	B	C	Y	P	L	P	W	S	
U	S	A	Q	L	E	D	D	C	L	T	O	M	A	S	L	E	D
S	D	F	E	S	Y	E	F	L	Q	T	N	U	I	D	A	R	F
T	F	G	M	U	J	G	E	W	N	O	I	S	N	B	T	G	
R	G	H	M	O	T	A	H	A	E	M	M	X	D	F	I	Y	H
I	H	J	E	H	C	A	J	R	R	O	I	O	I	G	O	N	J
E	J	K	R	I	I	K	T	I	T	P	C	P	F	C	G	U	G
S	K	L	D	K	O	V	A	L	A	M	S	Z	G	H	A	I	K
Z	L	H	A	Z	A	R	D	O	U	S	K	X	H	J	S	O	L
X	O	Z	T	J	O	L	X	F	U	E	L	R	O	D	S	P	Z
E	X	X	O	N	V	A	L	D	E	Z	L	C	I	K	S	L	X

# Comprehension Quiz

25

## Part A

Circle the word True if the statement is true. Circle the word False if it is false.

- 1) Corn stalks are an example of agricultural waste.  
True False
- 2) Hazardous mining waste can contaminate water supplies.  
True False
- 3) When oil is spilled from a tanker, it spreads out on the ocean floor.  
True False
- 4) High-level radioactive waste can remain harmful for thousands of years.  
True False
- 5) Solid waste from Hurricane Katrina is still a problem.  
True False
- 6) About 300 pieces of space junk can be found orbiting Earth.  
True False
- 7) Bio-economics is the study of how much money it costs to dispose of organic wastes.  
True False
- 8) Incinerators can cause air pollution.  
True False

## Part B

Put a check mark (✓) next to the answer that is most correct.

1. Which of these is high-level radioactive waste?
  - A uranium ore
  - B X-ray machines
  - C cancer medicines
  - D used fuel rods
2. Which of these substances are found in waste from metal mines?
  - A acids
  - B oil
  - C sewage
  - D fungicides
3. Which of these is an example of agricultural waste?
  - A cyanide
  - B acids
  - C fertilizer
  - D aluminum
4. Which facility will help a community practice zero waste?
  - A biogas
  - B incinerator
  - C landfill
  - D nuclear plant

# Waste from Asian Tsunami (Indonesia 2004)



NAME: \_\_\_\_\_

After You Read 



# Radioactive Waste

4. Explain the difference between **low-level** radioactive waste and **high-level** radioactive waste.

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5. Explain why **disposing** of high-level radioactive waste causes so many problems.

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## Extension & Application

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4. Answers will vary  
12  
Low-level radioactive waste breaks down faster.

5. Answers will vary  
13  
High-level radioactive waste takes thousands of years before it will no longer cause harm to people.

6. Answers will vary  
14  
Answers will vary

11  
15



# EASY MARKING ANSWER KEY