Let's Learn About Uranium

Teacher's Notes

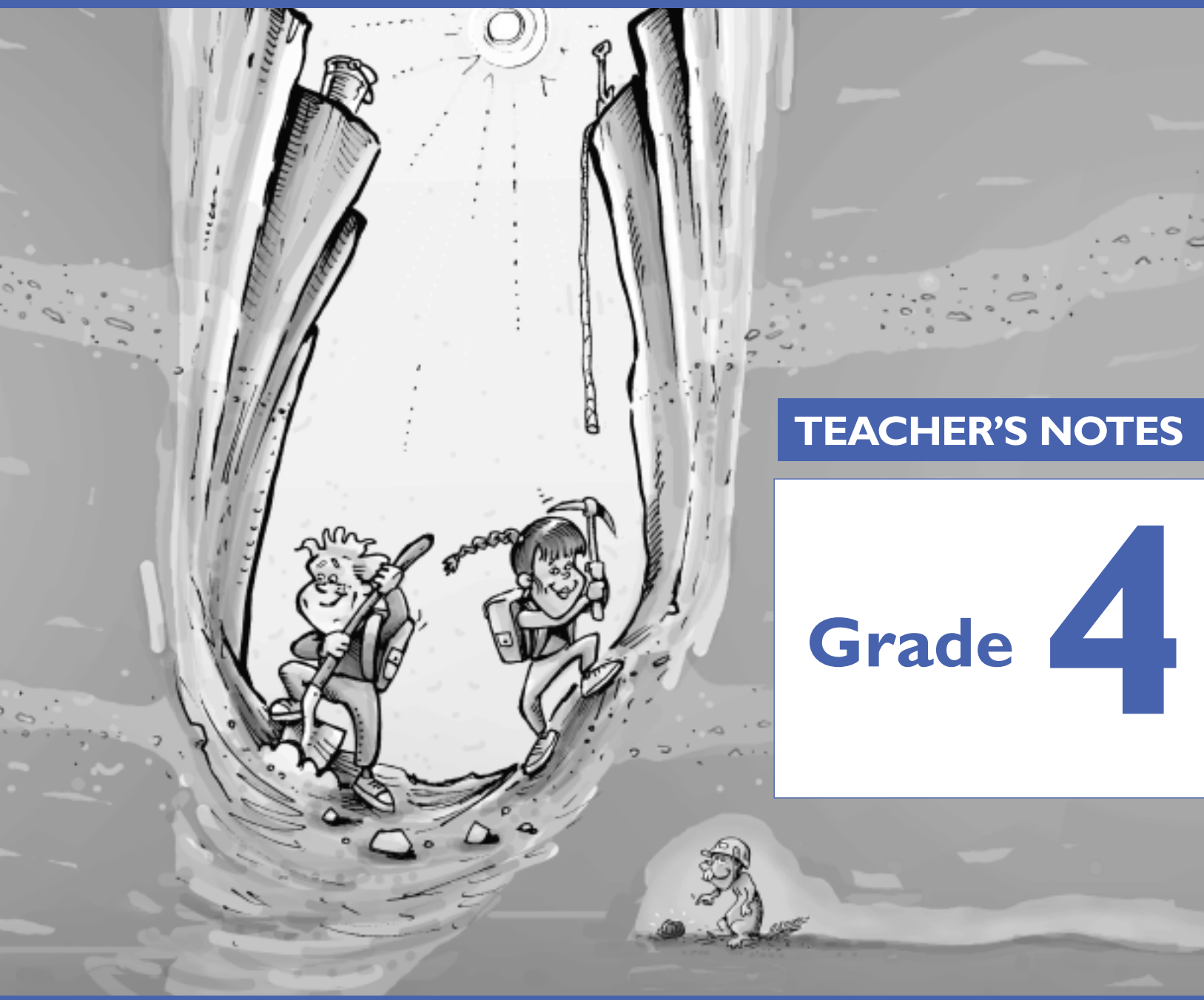
Introduction

These resource materials were designed with you, the educator in mind.

In the Teacher's Guide you will find a broad spectrum of information about nuclear energy from the structure of the uranium atom to the nuclear fuel cycle. It is written in a simple, factual way that we hope will help you to provide your students with a basic understanding of one of Saskatchewan's important industries.

The Teacher's Notes correspond with objectives in the Saskatchewan Science Curriculum for Grades 4, 5 and 6. The following notes, exercises and activities were developed to help teach specific objectives from this curriculum.

Let's Learn About URANIUM



TEACHER'S NOTES

Grade 4

Core Unit – Forms of Energy

The Grade 4 Resource package will help:

- **i)** Identify common forms of energy
- **ii)** Give examples of conversions of energy from one form into another
- **iii)** Explore the production and use of common forms of energy

4

Teacher Notes:

i) Identify common forms of energy

What Is Uranium?

Uranium is a common element in the Earth's crust. It is 500 times more abundant than gold. It is present in many things around us. It is found in rocks, soils, rivers and oceans. Traces of uranium are also found in food and in tissues of our bodies.

Uranium's atomic structure can be changed in a process that releases energy in the forms of heat and radiation. Uranium's primary use is to provide fuel for electrical generating stations, but it serves people in many other ways such as helping doctors treat and diagnose illnesses and preserving food.

Uranium is mined from rocks that contain an unusually high concentration of the element. Saskatchewan is the world's largest producer of uranium with four mines that provide about one third of the world's supply. Depending on where the ore is located, it can be extracted using either open pit or underground mining technology.

Once mined, the ore is sent to a nearby mill where the uranium is separated from the host rock by a chemical process and then dried. The end product is a powder called uranium oxide or "yellowcake." Yellowcake is sent to refineries and then processing facilities where it is prepared for use in nuclear reactors that generate electricity.

4

Teacher Notes:

i) Identify common forms of energy

Nuclear Energy

There are many different kinds of energy. Electrical energy is stored in the batteries that power toys and games. There's chemical energy in the fuels that burn in the engines of our cars and the furnaces in our houses. Solar energy from the Sun is the most abundant source of energy on Earth. It can be captured and converted into electricity with devices called solar electric cells like the ones on electronic calculators.

There's also energy in the atoms that are the basic building blocks of all things. Some kinds of atoms – such as uranium – can be split and changed into different atoms. When this happens, energy is released. This kind of energy is called nuclear energy.

4

Teacher Notes:

ii) Give examples of conversions of energy from one form into another

Nuclear to Electrical

Nuclear energy is changed into electrical energy at nuclear generating stations. These stations are built around nuclear reactors where all the necessary conditions to cause uranium atoms to split are put in place and sustained. When the uranium atoms split, they release heat energy and radiation. The heat of the nuclear reaction works like a stove element to boil water and produce steam.

Steam has potential to do a lot of work. Have you ever tried to hold the lid down on a pot of boiling water? You can't do it. The steam pushes out. At a nuclear generating station, steam under high pressure is used to turn big propellers called turbines that are connected to generators that create electricity. Nuclear energy is converted to mechanical energy and then into electrical energy.

4

Teacher Notes:

iii) Explore the production and use of common forms of energy

Rock to Energy

Imagine that you are holding a rock in your hand. It looks and feels just like a rock, right? It is hard to imagine, but some rocks are actually full of energy! The energy that powers your home or your family car has to come from somewhere. Much of the world's electricity needs are met by burning natural gas, coal and oil, or by harnessing the power of flowing water or the wind. But did you know that about 16 per cent of the world's electricity is generated by nuclear reactors, and that a rock – uranium – is the fuel used in these generating stations?

The process that this uranium rock or ore goes through to produce energy is called the nuclear fuel cycle. First, the ore is mined and milled to separate the uranium from other materials to get a uranium powder called "yellowcake." The yellowcake is further refined and processed to prepare it for use as nuclear fuel. The uranium is then made into small pellets about the size of a stack of dimes that are placed inside metal tubes called fuel rods. Fuel rods are assembled into bundles and inserted into a large device called a nuclear reactor.

Once the fuel bundles are inside the reactor, workers at the plant can create the conditions to get a controlled nuclear reaction that will make enough heat to boil water. When water boils, what do you get?

You get steam!

This steam is used to spin a big propeller called a turbine. The turbine spins a machine called a generator that makes electricity. Now we've gone from rock to energy!

Name _____

THE NUCLEAR FUEL CYCLE

Many steps are involved in the production of electricity from uranium. Ask the students to draw a picture of one of the following processes in the nuclear fuel cycle. When they are finished, ask the students to form a sequence of their drawings to represent the nuclear fuel cycle.

Mining
Rocks containing uranium are taken out of the ground

Milling
A chemical process is used to extract the uranium from the rocks

Fuel Processing
The uranium is refined and processed to make fuel for the reactor

Fuelling
The uranium fuel is placed in a nuclear reactor

Fission
The uranium atoms split inside the reactor creating heat

Steam Production
The heat boils water that circulates through the reactor

Generator
The steam turns a big propeller called a turbine

Electricity
The turbine turns a generator that makes electricity

THE CHOCOLATE CHIP COOKIE MINE

Objective: To help students become aware of the costs and benefits of mining.

Materials:
- Play money
- Chocolate Chip Cookies
- Pencils
- Notebook Paper
- Toothpicks and Paper Clips (several per student)
- Graph Paper (one sheet per student)

Procedure: Each student is the owner of a chocolate chip mine. First they buy the mine and necessary equipment, and then have five minutes to mine the chips. After the mining and cleanup, students calculate their costs and determine how much they will have to charge for each chip to break even. An average price is calculated from all the mines and that price is paid for each student's chips. The student with the most money at the end ran the most efficient mine.

Step 1 – Exploration

Students get $500 each in working capital. They pay $20 for a cookie and record the cost.

The cookie is placed on a sheet of graph paper and the student traces around it. Students then set their cookies aside and count the number of squares in the circle and record the number. Mining rights for each square or partial square cost $1. The cookie is then placed back in the circle.

Step 2 – Tooling Up

Each student buys mining equipment and records the cost. Toothpicks cost $10 each and a paperclip costs $15.

Step 3 – Mining

Students have five minutes to mine the chocolate chips from their cookie on the graph paper using toothpicks and paperclips (no fingers allowed). If equipment breaks, it must be replaced and the cost recorded.

After five minutes, students set aside their chocolate chips and pay $25 in operating costs.

Step 4 – Cleanup

Students must now clean up after their mine. Using their toothpicks and paperclips, they try to gather the pieces of their cookie back into the original circle on the graph paper. Then they trace around the pile of crumbs and count the number of squares inside and outside the original circle. Students must pay $1 in reclamation costs for each full or partial square touched by their mine.

Step 5 – Calculations

Each student now adds up all of his or her costs and divides it by the number of chocolate chips they mined. The result is the price they must charge for each chip to break even.

The minimum prices are added together and divided by the number of students in the class to get an average price. The average price is paid for each student's chocolate chips. Whoever ends up with most money ran the most efficient mine.

Adapted from "The Importance of Mining," U.S. Department of the Interior, Department of Mines.

Name: _____

WHO'S NUCLEAR?

Each of six students is assigned one of the following types of energy. Without using the names, other students ask yes-or-no questions in turn. After each question, he or she may guess what kind of energy the student is. If you guess right, you stay in the game. Guess wrong and you're out. Each student gets one pass on guessing.

Nuclear Energy
The energy stored in the nucleus of atoms, the basic building blocks of all things. This energy is released when some kinds of atoms split to form new atoms.

Mechanical Energy
The energy in a moving object. A rolling bicycle or a thrown ball has mechanical energy.

Chemical Energy
The energy stored in the chemical bonds that hold particles of matter together. The energy that your body gets from food and cars get from gasoline is chemical energy.

Electrical Energy
This is the energy in moving electrical particles. It makes your toaster work, lights the lights in your house and powers other electrical devices.

Gravitational Energy
This is the energy that causes things to fall to Earth. It is caused by the attraction of objects to each other.

Magnetic Energy
This kind of energy causes some kinds of metal to be attracted to one another.

Name _____

URANIUM MINING

Ask the students to write a short story or rap song about how uranium helps our province using the words in the box.

Or fill in the blanks using the words in the box.

ROCKS	MINED	SASKATCHEWAN
PRODUCE	NUCLEAR	UNUSUALLY
FOUR	THIRTY	NORTHERN
	ELECTRICAL	

_____ is the world's largest producer of uranium. The _____ at some places in the _____ part of the province have an _____ high amount of uranium in them. The _____ mines in these areas produce _____ per cent of the world's supply of uranium. Almost all of the uranium _____ in Saskatchewan is used to _____ electricity at power stations that convert _____ energy to _____ energy.

URANIUM MINING

Answers

ROCKS	**MINED**	**SASKATCHEWAN**
PRODUCE	**NUCLEAR**	**UNUSUALLY**
FOUR	**THIRTY**	**NORTHERN**
	ELECTRICAL	

SASKATCHEWAN is the world's largest producer of uranium. The **ROCKS** at some places in the **NORTHERN** part of the province have an **UNUSUALLY** high amount of uranium in them. The **FOUR** mines in these areas produce **THIRTY** per cent of the world's supply of uranium. Almost all of the uranium **MINED** in Saskatchewan is used to **PRODUCE** electricity at power stations that convert **NUCLEAR** energy to **ELECTRICAL** energy.

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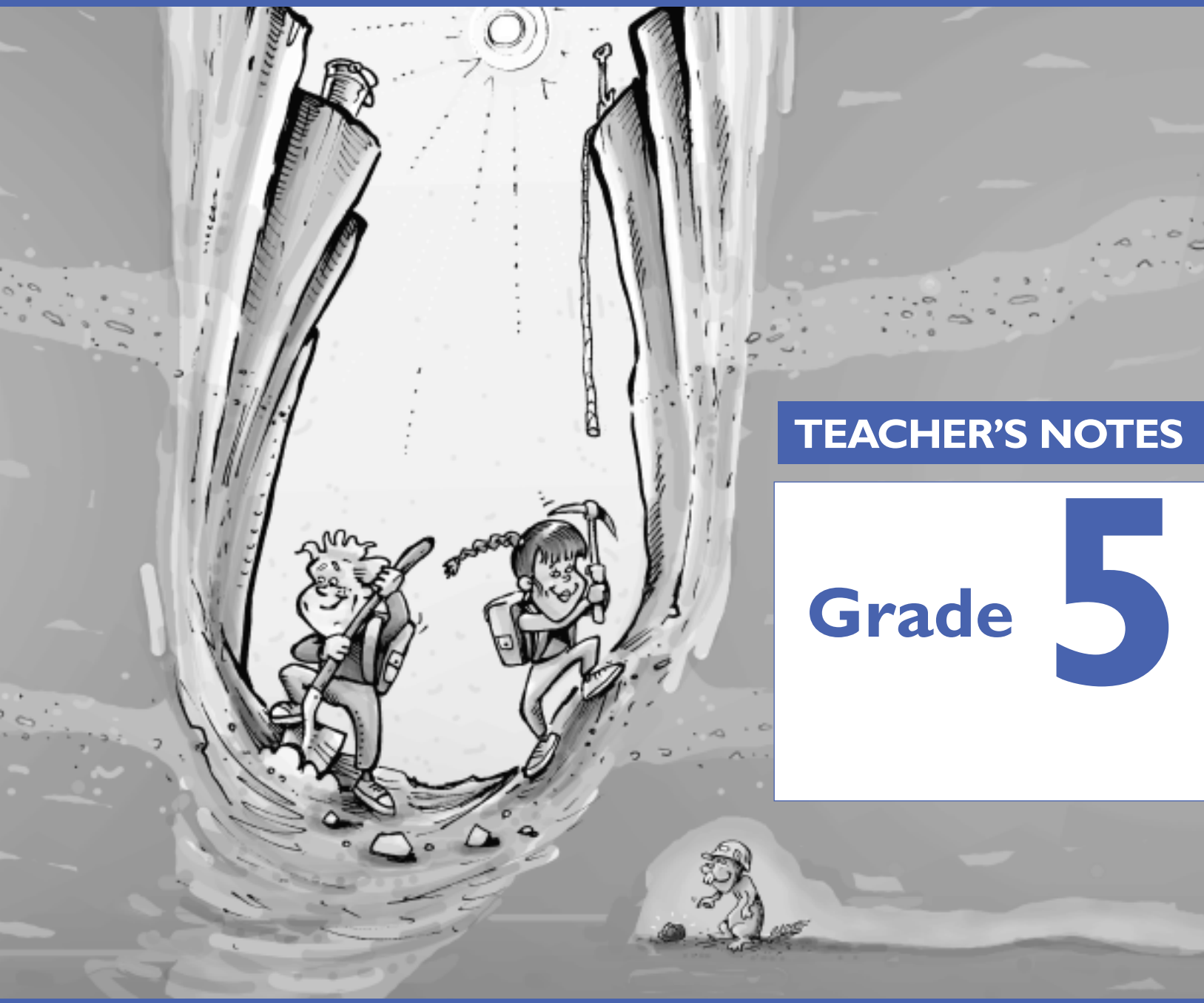


TEACHER'S NOTES

Grade 5

Core Unit – Matter and its Changes / Resources

The Grade 5 Resource package will help:

- **i)** Describe the atom as a basic unit of matter
- **ii)** List examples of natural resources found in Saskatchewan
- **iii)** Classify the natural resources of Saskatchewan as renewable and non-renewable
- **iv)** Distinguish between resources used to produce energy and those used to produce goods

5

Teacher Notes:

i) Describe the atom as a basic unit of matter

Energetic Atoms

All kids like to build. Any kind of building blocks can produce the tallest of towers, ramps and houses of all shapes and sizes. These blocks can be compared to atoms.

Atoms are the basic building blocks of all matter. That means that all things are made up of atoms, even you! Imagine the sun with the planets orbiting around it. This is what an atom would look like if we could see one. The sun is the nucleus with positively charged protons and uncharged neutrons. The planets are the electrons circling around it.

Most atoms are stable, meaning they do not change. Most of the atoms that make up your body are stable. But some atoms contain too much energy and are unstable. These elements, like uranium, can have several different forms or atomic structures with nuclei that have different masses. These different forms are called isotopes.

When isotopes change they release energy in the form of radiation. There are several different types of radiation. When uranium decays, its excess energy is released in the form of gamma waves and alpha and beta particles. Gamma rays can pass through most materials, but lose energy in the process. About one metre of concrete will block gamma rays. Alpha particles can be blocked by a sheet of paper. Beta particles can be blocked by heavy clothing or a thin sheet of aluminum.

Radiation has lots of potential to help or harm people just like other forms of energy.

5

Teacher Notes:

ii) List examples of natural resources found in Saskatchewan

A Natural Resource

Uranium is one of Saskatchewan's greatest energy resources. The province has lots of coal, oil and natural gas, but we are the world's biggest producer of uranium. The deposits of uranium found in the rocks at some places in northern Saskatchewan are among the richest in the world. That means there is an unusually high amount of uranium in the rock and an enormous amount of energy.

The mines in Saskatchewan produce about one third of the uranium used to generate nuclear electricity around the world. That's an awful lot of energy and it is produced without releasing greenhouse gases.

5

Teacher Notes:

ii) List examples of natural resources found in Saskatchewan

What Is Uranium?

Uranium is a common element in the Earth's crust. It is 500 times more abundant than gold. It is present in many things around us. It is found in rocks, soils, rivers and oceans. Traces of uranium are also found in food and in tissues of our bodies.

Uranium's atomic structure can be changed in a process that releases energy in the forms of heat and radiation. Uranium's primary use is to provide fuel for electrical generating stations, but it serves people in many other ways such as helping doctors treat and diagnose illnesses and preserving food.

Uranium is mined from rocks that contain an unusually high concentration of the element. Saskatchewan is the world's largest producer of uranium with four mines that provide about one third of the world's supply. Depending on where the ore is located, it can be extracted using either open pit or underground mining technology.

Once mined, the ore is sent to a nearby mill where the uranium is separated from the host rock by a chemical process and then dried. The end product is a powder called uranium oxide or "yellowcake." Yellowcake is sent to refineries and then processing facilities where it is prepared for use in reactors that generate electricity.

5

Teacher Notes:

iii) Classify the natural resources of Saskatchewan as renewable and non-renewable

Use It and Lose It

Like the other major energy resources found in Saskatchewan, uranium is non-renewable. Think of the gas in your family's car. That gas came from oil that was pumped out of the ground and then refined at a big chemical plant. Once it is burned up in the car's engine, it's gone forever.

Uranium is similar. It is taken out of the ground, milled, processed and used as fuel in a nuclear reactor. But there is a lot more energy in uranium. Even after it has been used in a reactor to generate electricity, uranium can be reprocessed and used again in a different type of reactor.

Our technology has not reached the point where we can rely on renewable forms of energy. Until we get there, we have to use non-renewable forms. Nuclear power is a good option because it can produce energy efficiently without releasing greenhouse gases.

5

Teacher Notes:

iv) Distinguish between resources used to produce energy and those used to produce goods

Generating Electricity Using Uranium

There are many different kinds of energy. Electrical energy is stored in the batteries that power toys and games. There's chemical energy in the fuels that burn in the engines of our cars and the furnaces in our homes. Solar energy from sunlight is the most abundant source of energy on Earth. It can be captured and converted into electricity with devices called solar electric cells like the ones on electronic calculators.

There's also energy in the atoms that are the basic building blocks of all things. Some kinds of atoms – such as uranium – can be split and changed into different atoms in a process called nuclear fission. When this happens, energy is released. This kind of energy is called nuclear.

Nuclear energy can be changed into electrical energy by a nuclear power plant. Inside the reactor, uranium atoms in fuel bundles are caused to split releasing heat energy and radiation. The heat is used to boil water producing steam. The steam is used to turn big propellers called turbines that are connected to generators that create electricity. Nuclear energy is converted into mechanical energy and then into electrical energy.

This process is one of the cleanest ways to generate large amounts of electricity. Nuclear reactors do not create greenhouse gases that can harm the environment. The only waste produced by the reactor is spent fuel that continues to produce radiation for a very long time after it is removed from a reactor. As a result, used reactor fuel must be carefully handled and safely stored.

Name _____

NON-RENEWABLE ENERGY

Non-renewable energy resources are sources of energy that are not continuously available and will eventually run out.

1. Identify as many kinds of **NON-RENEWABLE** energy resources as you can:

_____

_____

_____

_____

_____

_____

2. Explain why the energy resources you chose could be described as **NON-RENEWABLE.**

3. Research one **NON-RENEWABLE** energy resource and describe:

Where it is found?
How it is used?
What is the environmental impact of its use?

Name: _____

SASKATCHEWAN ENERGY RESOURCES

Our province is rich in non-renewable energy resources. Divide students into groups and ask each to research one of Saskatchewan's non-renewable energy resources. Ask each group to make a presentation to the class on why their resource is the best.

1. Coal

2. Uranium

3. Oil

4. Natural gas

Name _____

RENEWABLE AND NON-RENEWABLE RESOURCES

Compare and contrast the following energy sources and resources by placing the renewable resources and energy forms inside the Sun shape and the non-renewable energy sources and resources inside the drum.

ENERGY SOURCES

Hydro
Solar
Wind
Biomass
Geothermal
Coal
Oil
Uranium
Peat Moss

RESOURCES

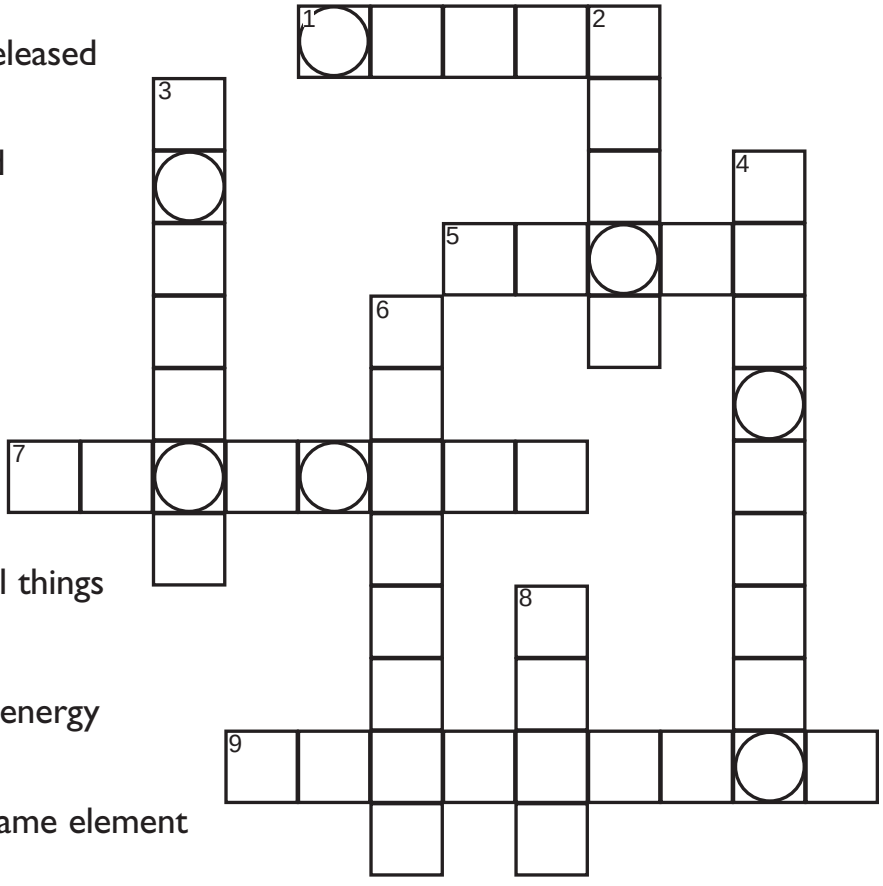
Gold
Copper
Forests
Fish
Agriculture
Potash
Product
Livestock

Name: _____

GOIN' FISSION

Solve this crossword puzzle and answer the following question using a word formed with the circled letters.

What naturally occurring radioactive element is found in most of Earth's rocks, soils, lakes, oceans, rivers and even in our own bodies?



ACROSS

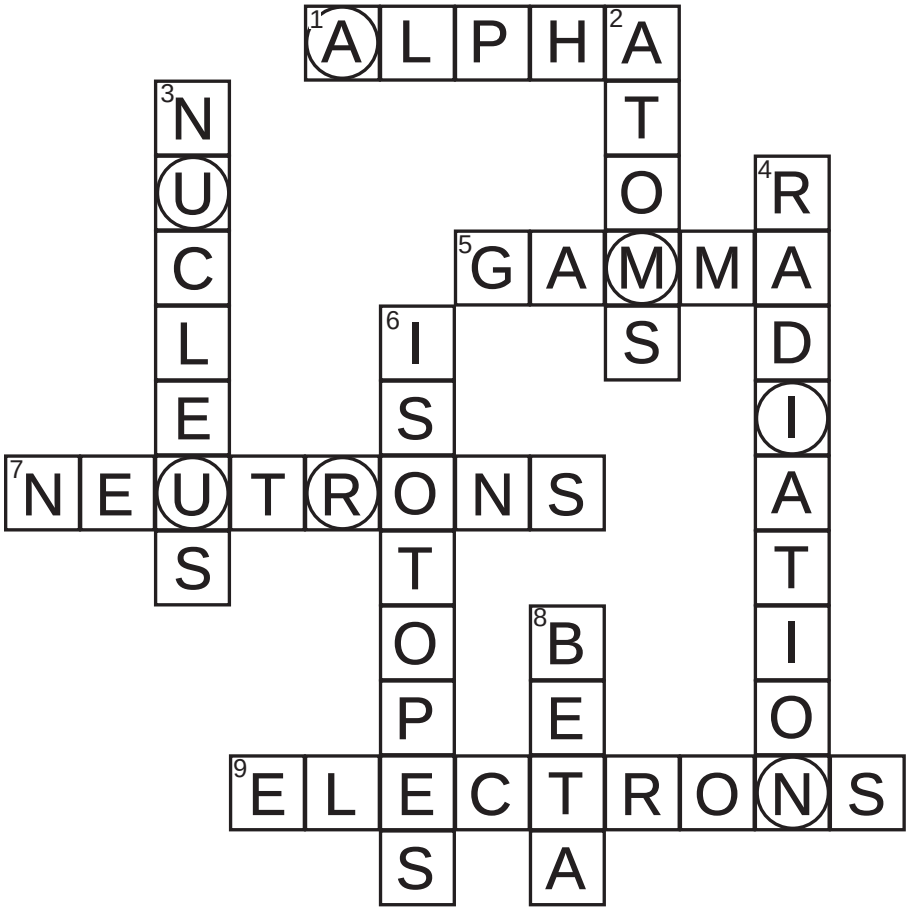
1. One kind of radiation released by unstable atoms
5. Powerful waves released by unstable atoms
7. The centre of an atom has protons and these
9. These orbit around the centre of an atom

DOWN

2. The building blocks of all things
3. The centre of an atom
4. Unstable atoms release energy in this form
6. Different forms of the same element are called this
8. Another kind of radiation released by unstable atoms

GOIN' FISSION

Answers



What naturally occurring radioactive element is found in most of Earth's rocks, soils, lakes, oceans, rivers and even in our own bodies?

U-R-A-N-I-U-M

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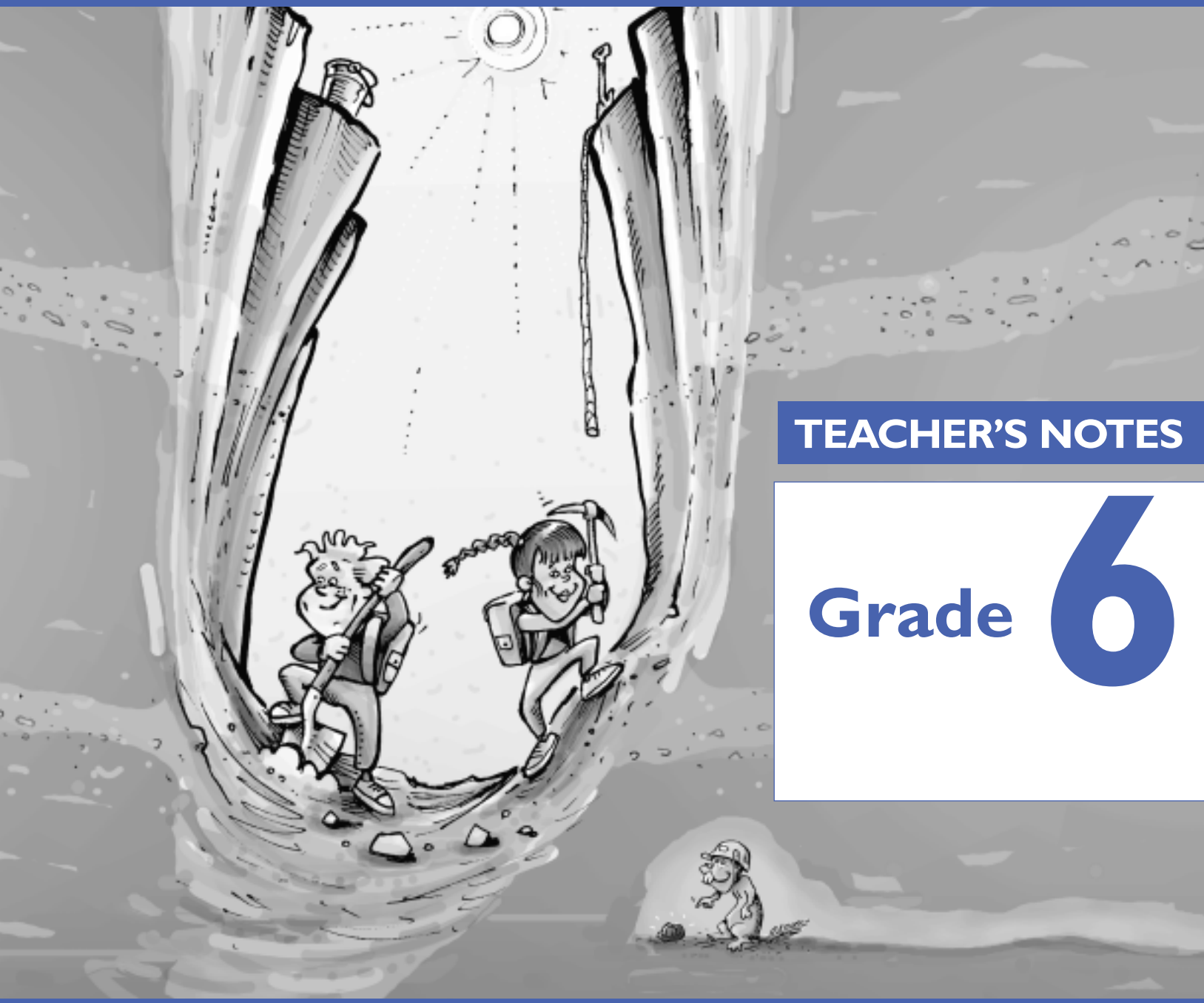

TEACHER'S NOTES

Grade 6

Core Unit – Energy in Our Lives

The Grade 6 Resource package will help:

- **i)** Identify various forms of energy
- **ii)** Examine conversions of energy between forms
- **iii)** Appreciate how technological developments affect culture and society
- **iv)** Investigate how forms of energy are created and transmitted

6

Teacher Notes:

i) Identify various forms of energy

What Is Uranium?

Uranium is a common element in the Earth's crust. It is 500 times more abundant than gold. It is present in many things around us. It is found in rocks, soils, rivers and oceans. Traces of uranium are also found in food and in tissues of our bodies.

Uranium's atomic structure can be changed in a process that releases energy in the forms of heat and radiation. Uranium's primary use is to provide fuel for electrical generating stations, but it serves people in many other ways such as helping doctors treat and diagnose illnesses and preserving food.

Uranium is mined from rocks that contain an unusually high concentration of the element. Saskatchewan is the world's largest producer of uranium with four mines that provide about one third of the world's supply. Depending where the ore is located, it can be extracted using either open pit or underground mining technology.

Once mined, the ore is sent to a nearby mill where the uranium is separated from the host rock by a chemical process and then dried. The end product is a powder called uranium oxide or "yellowcake." Yellowcake is sent to refineries and then processing facilities where it is prepared for use in reactors that generate electricity.

6

Teacher Notes:

i) Identify various forms of energy

Nuclear Energy

Nuclear energy is the energy stored in the nucleus of atoms, the basic building blocks of all matter. Some of this energy is released in a process called nuclear fission that occurs when the structure of an atom changes.

The energy is released as heat and different types of radiation such as gamma rays, alpha particles, beta particles and neutrons. Since the discovery of nuclear energy more than a century ago, scientists have learned how to harness it effectively.

One of the first uses of nuclear energy was for weapons during the Second World War, but today, nuclear energy is most commonly used to generate electricity in nuclear reactors. Nuclear power stations fuelled by uranium are very efficient. One truckload of uranium contains the same amount of energy as many trains loaded with coal.

6

Teacher Notes:

ii) Examine conversions of energy between forms

From Nuclear to Electrical

About 16 per cent of the world's electricity is generated by nuclear reactors. Uranium is the fuel for these plants. The process that uranium goes through to change from a rock in the ground to fuel for a reactor is called the nuclear fuel cycle.

Rock containing uranium is mined from the ground and taken to a mill where the uranium is separated from other material by a chemical process and then packaged in steel drums as a dry powder called uranium oxide concentrate or "yellowcake." The yellowcake is then sent by truck to processing facilities where it is prepared for use as nuclear fuel. This process creates a uranium dioxide powder that is then formed into small pellets. Each pellet is about the size of a stack of dimes. Seven such pellets can produce enough electricity to meet the annual electrical needs of a typical Canadian household. The pellets are arranged in rows and encased in a special steel alloy to form fuel rods. A number of these rods are arranged into a fuel bundle.

The bundles are inserted into a reactor where all the necessary conditions to cause uranium atoms to split are put in place and sustained. Heat produced by the nuclear reaction is used to boil water to produce steam. The steam is used to turn big propellers called turbines that are connected to generators that create electricity. Nuclear energy is converted into mechanical energy and then into electrical energy.

6

Teacher Notes:

iii) Appreciate how technological developments affect culture and society

Other Uses for Uranium

Most people know that uranium can be used to generate electricity, but it helps people in other ways that might surprise you.

Uranium has allowed scientists to create materials called radioisotopes by bombarding different elements with neutrons. The radioactive materials created by this process have become important tools in protecting human health, food supplies, and in many kinds of advanced research. Doctors use them to treat diseases such as cancer with special techniques, some of which were developed right here in Saskatchewan.

They have other uses too. Radioisotopes help preserve foods like grains, fruit and vegetables and can be used to sterilize medical equipment. There's probably one in the smoke detector that protects you and your family. They are useful to researchers developing new plant varieties and tracking pollutants in the environment.

As an efficient source of energy, uranium powers many large ships like ice-breakers, aircraft carriers and submarines because it allows them to remain at sea longer without refuelling. Nuclear energy is even used in space exploration to power some space craft.

6

Teacher Notes:

iv) Investigate how forms of energy are created and transmitted

Uranium Fuels Clean Electricity Generation

The world has a big appetite for electricity and it grows every year. Feeding that appetite will be a big challenge in the future. Luckily, there are many ways to generate electricity without releasing greenhouse gases that many scientists believe are affecting the global climate. Wind and solar generating systems convert wind and sunlight into electricity. Hydro uses the energy of moving water to generate electricity.

While these sources of energy have the least effect on the environment, they can't make enough electricity to meet the world's growing needs. That means we have to use "thermal generation" where different types of fuel are used to heat water to produce steam. The pressurized steam is used to turn a big propeller called a turbine that spins large electrical generators. This is the way most of the world's electricity is made.

Most thermal plants burn fossil fuels such as coal, oil and natural gas to generate the steam. The burning of any kind of fossil fuel releases greenhouse gases. With nuclear energy, the heat is created by splitting uranium atoms. There are no emissions to the environment. The only waste is the used uranium fuel which is stored and monitored after it is used in a reactor.

About 16 per cent of the world's electricity is now generated at nuclear power plants. In Canada we get about 14 per cent of our electricity from nuclear reactors or enough to meet the electrical needs of 6 million households.

ACTIVITIES

1. Rocks to Energy
Ask students to write a brief paper and diagram describing the process by which rocks containing uranium are used to generate electricity. Be sure to identify where energy changes from one form to another.

2. What's Best?
Divide students into groups and ask them to research the advantages of each of the electricity generation systems below. Appoint three students as judges and conduct a debate on which generation system best meets society's growing appetite for electricity.

- Hydroelectric
- Coal- and gas-burning power plants
- Nuclear power plants
- Wind
- Solar

3. Enriching Us
Ask students to research Saskatchewan's role in providing uranium for nuclear reactors around the world and write a brief paper on how it affects people in our province.

Name _____

NUCLEAR QUIZ

Answer the following questions in the space provided using complete sentences. Please use examples wherever possible to explain your answers.

1. What is uranium?

2. Describe how uranium oxide is produced from uranium ore. What is another name for uranium oxide?

3. Compare and contrast a nuclear fuel reactor to a match. Make a chart to help you make this comparison (use the back of this page).

Name _____

NUCLEAR QUIZ

Answer the following questions in the space provided using complete sentences. Please use examples wherever possible to explain your answers.

4. Define these terms:

   Fission

   Isotope

   Turbine

   Generator

5. Is nuclear energy a clean way to produce electricity? Explain your answer.

NUCLEAR QUIZ

Answers

1. **What is uranium?**
   Uranium is a naturally occurring element that is found in most of Earth's soils, rocks and water bodies. It is unique because its atomic structure can be changed in a process that releases energy in the forms of heat and radiation. Uranium is the fuel used to produce electricity at nuclear generating stations around the world. It also provides many other benefits such as helping doctors diagnose and treat illnesses and preserving foods.

2. **Describe how uranium oxide is produced from uranium ore. What is another name for uranium oxide?**
   Uranium ore, or rock containing a large amount of uranium, is crushed and fed into a mill at the mine site where uranium is separated from other material through a chemical process. The final product of the mill is uranium oxide powder, also known as yellowcake.

3. **Compare and contrast a nuclear fuel reactor to a match. Make a chart to help you make this comparison**.
   A match and a nuclear reactor both have potential to create energy. The lighting of a match is a chemical reaction that generates heat. The energy created by a nuclear reactor comes from a process called nuclear fission where uranium atoms split releasing energy in the forms of heat and radiation.

NUCLEAR QUIZ

Answers

4. **Define these terms:**

   Fission: Fission is the splitting of the nucleus of an atom which is accompanied by the release of energy in the forms of heat and radiation.

   Isotope: Isotopes are different forms of atoms of the same chemical element. Isotopes are distinguished by the number of protons and neutrons in their nuclei.

   Turbine: A turbine is a device like a propeller that is rotated by the motion of fluids such as steam or water. At a nuclear generating station, steam produced by the fission of uranium atoms inside a nuclear reactor is used to turn turbines that spin generators to create electricity.

   Generator: A generator is a device that converts mechanical energy into electricity.

5. **In your opinion, is nuclear energy a clean way to produce electricity? Explain your answer.**
   Nuclear energy is a clean way to produce electricity because it doesn't release any emissions into the atmosphere. The only waste from a nuclear generating station is the spent fuel which must be removed from the reactor and carefully handled and stored.

Name _____

NUCLEAR ENERGY AND THE ENVIRONMENT

Survey at least three people to collect more information using the questions below. Then, using the information you gather, write a one-page paper to answer the following question:

Is nuclear energy a safe and sustainable form of energy for us and the environment?

1. Can you name three forms of energy?

2. What forms of energy do you use every day?

3. What is uranium? Where is it mined?

4. What are some of the uses for uranium?

5. What is nuclear energy?

6. How important is it to you that we use clean forms of energy?

7. Do you think that we have a responsibility to the environment? Explain your response.

8. Do you have any comments or questions?

NUCLEAR ENERGY AND THE ENVIRONMENT

Answers

1. **Can you name three forms of energy?**
   Chemical; nuclear; electrical; mechanical

2. **What forms of energy do you use every day?**
   Chemical (furnace, water heater, car engine etc.); electrical (computer, radio, lights etc.)

3. **What is uranium? Where is it mined?**
   Uranium is a common element with an unstable atomic structure that can change through a process called nuclear fission that releases energy in the forms of heat and radiation. It is mined on every continent except Antarctica. Saskatchewan is the world's largest producer of uranium.

4. **What are some of the uses for uranium?**
   Uranium is most commonly used as fuel for nuclear reactors that generate electricity and power large ships like aircraft carriers and submarines. Uranium is also used to create materials called radioisotopes that provide many benefits to people including improved diagnosis and treatment of illnesses and preservation of foods.

5. **What is nuclear energy?**
   Nuclear energy is the heat and radiation produced by the splitting or fission of atoms.

6. **How important is it to you that we use clean forms of energy?**
   Clean forms of energy are less destructive to the environment that supports all life on Earth.

7. **Do you think that we have a responsibility to the environment? Explain your response.**
   Every individual has a responsibility to help protect the environment for future generations of people and living creatures.

Name _____

CLEAN ENERGY

You have learned about the process of changing uranium into electricity. You have also learned that this is a clean form of energy for our planet.

1. What is clean energy?

2. How important is energy to our lifestyles? How important is clean energy to our lifestyles?

3. Why is uranium considered a form of clean energy?

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Answers

1. **What is clean energy?**
   Clean energy is energy produced without creating pollution or harming the environment.

2. **How important is energy to our lifestyles? How important is clean energy to our lifestyles?**
   Energy is essential to our modern lifestyle. We need it for transportation, communication, to produce heat and light for our homes and offices, and to produce all of the goods we consume and use.

3. **Why is uranium considered a form of clean energy?**
   Uranium can be considered a form of clean energy because it can produce electricity without releasing greenhouse gases into the atmosphere. The only waste from a nuclear generating station is the spent uranium fuel which must be removed from the reactor and be carefully handled and stored.