



Teachers' Answer Key

**For educators, group leaders
and volunteer guides**

GRADE 4 and under RESOURCES AND YOU

Canadian Natural

Where are oil and natural gas deposits found underground?

- In underground rivers In large, open caverns • **In open pore spaces between rock grains**

CREWES, University of Calgary

What does a seismometer record?

- **Earthquakes** Music Television programs Sales

Inside Education (Monday, Tuesday only)

What is a natural resource?

- **A substance from nature that is used to meet human needs**
Something that lasts forever Something that disintegrates

Mining Matters

What can you see by looking at a thin section of a rock under a microscope?

- Nothing • **The minerals in the rock** Dots More rocks

Natural Resources Canada - Geological Survey of Canada

Match the regions with the most common types of rock(s) found there

- Prairies: Igneous rocks Metamorphic rocks • **Sedimentary rocks** All types of rocks
Canadian Shield: • **Igneous rocks** • **Metamorphic rocks** Sedimentary rocks All types of rocks
Rocky and Appalachian Mountains: Igneous rocks Metamorphic rocks Sedimentary rocks
• **All types of rocks**
Offshore: Igneous rocks Metamorphic rocks • **Sedimentary rocks** All types of rocks

Yukon Dan Gold Panning

What is Gold Fever?

- **The sickness for gold (money)** Illness suffered by gold miners

GRADE 4 and under

ENERGY FOR US

Canada Action

Over millions of years heat and pressure slowly transformed decayed animals and _____ into the fossil fuels we use today.

Crayons • **Plants** Pizza

Canadian Association of Geophysical Contractors

Which of these animals could we encounter when working in Western Canada?

• **Caribou** Camel • **Lynx** • **Grizzly Bear** Elephant • **Elk** Tiger

Canadian Nuclear Society

What is Canada's rank among world Uranium producers?

1st • **2nd** 3rd

Canadian Rockies Earth Science Resource Centre (CRESRC)

What device is used for detecting seismic waves while exploring for oil and/or natural gas?

Radio Microscope • **Geophone**

CSPG Foundation

What do petroleum geologists explore for?

• **Oil and Natural gas** Uranium Gold

ESfS Trilobite Fossil Station

Trilobites are some of the oldest fossils on earth. How many years old are they?

5,000 100 million • **500 million** 900 million

Let's Talk Science

What is the ultimate source of wind energy?

Thunderstorms The moon • **The sun**

PetroLMI

What is the most common way to transport Canadian oil and gas?

• **Pipeline** Rail (train) Truck Ship

Society of Petroleum Engineers Calgary Section

What is petroleum? (*Petroleum is a fossil fuel, meaning that it has been created by the decomposition of organic matter over millions of years.*)

• **Petroleum is a naturally occurring liquid found beneath the Earth's surface that can be refined into fuel.**

The liquid bought at gas stations A kind of jelly

GRADE 4 and under ONE DYNAMIC EARTH

Burgess Shale Geoscience Foundation

About how old is the Earth?

4.5 Thousand years 4.5 Million years ● **4.5 Billion years**

Calgary Rock and Lapidary Club

What is a common rock that can be easily found in Calgary?

Granite Basalt Agate Limestone Quartz ● **Sandstone**

Calgary Zoo

Decomposers change soil composition by doing what?

Breaking down rocks into smaller pieces

Changing rocks into decaying material

● **Breaking down decaying plants and other material into minerals that plants can use**

Changing decaying material into rocks

Canmore Museum and Geoscience Centre

What type of rock is used to make objects you might eat or drink out of?

● **Shale** Limestone Sandstone

Department of Geoscience

Which continually occurring process causes mountains to become smaller with passage of time?

Earthquakes Volcanoes Landslides ● **Erosion**

Frank Slide Interpretive Centre

What is the primary type of rock that fell from the top of Turtle Mountain?

Sandstone Shale Conglomerate ● **Limestone**

Ocean Networks Canada

Ocean Networks Canada uses scientific instruments, such as hydrophones, to study the ocean. One of the choices below CANNOT be heard on a hydrophone. Which one is it?

Earthquakes

Marine mammals such as whales and dolphins

Snowmobiles

● **Jellyfish swimming**

Parks Canada Agency

Find a Burgess Shale fossil. How old is it?

500 thousand years ● **500 million years** 500 years

Roots 2 STEM

What is the only type of rock that can float on water?

Sandstone ● **Pumice** Granite

GRADE 4 and under OUR FUTURE!

AirTerra Inc.

Something plants do not need to survive

Water Sunlight • Sugar Nutrients Carbon Dioxide

Canadian Society of Exploration Geophysicists

How old is the planet Earth?

4000 years 4.6 million years • 4.6 billion years

Canadian Space Agency / Agence spatiale canadienne

True or false: Farmers can use radar images to monitor their crops.

• True False

Earth Science Stories

What is an ammonite?

A type of meteorite A rock • A sea-shell creature that died out with the dinosaurs

Energy Production and Transmission Canadian Geographic Giant Floor Map

How is most oil and natural gas transported from Alberta to the rest of Canada and the USA?

Trains Trucks Airplanes • Pipelines

Evict Radon

Is radon?

Solid Liquid • Gas

Journey 2050

How much water is needed to make a pair of jeans?

110 litres 1,100 litres • 11,000 litres (small swimming pool)

Lafarge Canada Inc.

Where do you find everyday uses for sand and gravel?

Buildings (houses, school, etc.) Roads Sidewalks • All of these

Rothney Astrophysical Observatory

What is a satellite?

• A human made machine that orbits the earth An asteroid A meteorite

Royal Astronomical Society of Canada

What is a simple thing you could look for if you think a rock is a meteorite?

Fossils Air bubbles • Magnetic minerals

Women in Science and Engineering (WISE)

Which of the following would be the most viscous substance?

Milk • Honey Oil Water

GRADE 5 and over RESOURCES AND YOU

Canadian Natural

What are the two main types of data used by Geoscientists to identify possible locations of hydrocarbon reservoirs underground?

- **Well logs**
- Density curves
- Gravity maps
- **Seismic data**

CREWES, University of Calgary

What are three types of man-made seismic sources?

- **Dynamite**
- **Vibroseis**
- **Weight-drop**
- Earthquakes

Inside Education

Which of the following non-renewable resources are used to produce energy?

- Coal
- Natural gas
- Oil
- Uranium
- **All of these**

Mining Matters

Why would a scientist want to look at a thin section of rock under a microscope?

- To see the shape of the particles
- To see the different minerals in the rock
- To better understand some of Earth's processes
- **All of these**

Natural Resources Canada - Geological Survey of Canada

Match the regions with the types of energy extracted or produced there:

- | | | | | | | |
|--------------------|----------------------|---------------|------------------|-------------------------|---------------|----------------|
| Sedimentary Basins | • Oil and Gas | • Coal | Nuclear | Hydro-electric | • Wind | • Solar |
| Canadian Shield | Oil and Gas | Coal | • Nuclear | • Hydro-electric | • Wind | • Solar |
| Mountains | • Oil and Gas | • Coal | Nuclear | • Hydro-electric | • Wind | • Solar |
| Offshore | • Oil and Gas | Coal | Nuclear | Hydro-electric | • Wind | Solar |

Yukon Dan Gold Panning

What mineral tricked many people?

- Sulphur
- Calcite
- **Iron pyrite (fool's gold)**

GRADE 5 and over

ENERGY FOR US

Canada Action

After oil is retrieved from the ground, it is refined into many products we use every day. Which of these are made from petroleum?

- Plastics Asphalt for roads Cellphones, computers ● **All of these**

Canadian Association of Geophysical Contractors

Which of these jobs do we do on a seismic program?

- **Safety Manager** ● **Driller** Doctor ● **Permit man**
● **Surveyor** ● **Helicopter Pilot** ● **Jug Hound** Architect

Canadian Nuclear Society

How many years can nuclear energy sustain our civilization?

- 100 1000 10,000 100,000 ● **Over 1,000,000**

Canadian Rockies Earth Science Resource Centre (CRESRC)

Which is the most common geophysical method used for accurately locating oil in the Earth?

- **Seismic Survey** Aeromagnetic Survey Gravity Survey

CSPG Foundation

How do petroleum geologists find oil and natural gas?

- By hitting rocks with hammers By surveying with a divining rod
● **By drilling wells and working with exploration geophysicists and engineers**

ESFS Trilobite Fossil Station

When trilobites grow and shed their shell it is called....

- Growth Spurt Shell Removal ● **Moulting** Dead Skin

Let's Talk Science

What is the purpose of the gearbox in a horizontal-axis wind turbine?

- Scare away birds Convert wind power to electricity
● **Increase rotation speeds of the shaft to maximize generator activity**

PetroLMI

What products are made available because of oil and gas?

Gasoline and diesel fuel for cars, trucks, buses, trains, boats, jet fuel for airplanes, natural gas to heat homes
Toothpaste, telephones, garden tools, lipstick.

Plastics, synthetic rubber, lubricants, paints, solvents, asphalt and roofing, insulation and fertilizers.

- **All of these**

Society of Petroleum Engineers Calgary Section

How does the oil and gas industry make use of carbon dioxide?

- **It can be injected into oil wells to help push the oil to surface and increase recovery**
It is mixed with other gases to reduce its effect
It is added to refined petroleum

GRADE 5 and over

ONE DYNAMIC EARTH

Burgess Shale Geoscience Foundation

About how old are the Burgess Shale fossils?

510 Centuries

510 Thousand years

● **510 Million years**

Calgary Rock and Lapidary Club

What category is the rock limestone from?

Igneous

Metamorphic

● **Sedimentary**

Calgary Zoo

Organisms preserve as fossils differently depending on the structure of the organism and where they laid for preservation. Choose the order of best preservation for the following organisms:

Whooping crane feather, turtle shell, gorilla metatarsal (hand bone), red wiggler worm

● **Turtle shell, gorilla metatarsal (hand bone), whooping crane feather, red wiggler worm**

Gorilla metatarsal (hand bone), turtle shell, whooping crane feather, red wiggler worm

Turtle shell, gorilla metatarsal (hand bone), red wiggler worm, whooping crane feather

Canmore Museum and Geoscience Centre

What rock found in the Bow Valley is made from compressed organic material?

Limestone

Sandstone

● **Coal**

Department of Geoscience

Why are there fewer craters on the surface of the Earth compared to the Moon?

Earth is younger than the Moon

Earth's oceans cover the craters

Earth was hit by fewer meteorites

● **Craters on Earth were erased by erosion and other processes**

Frank Slide Interpretive Centre

An estimated _____ tonnes of rock fell from Turtle Mountain in _____ seconds.

1 billion tonnes / 450 seconds

33 million tonnes / 30 seconds

500 tonnes / 5 minutes

● **110 million tonnes / 90 seconds**

Ocean Networks Canada

Ocean Networks Canada uses scientific instruments, such as hydrophones to study the ocean. One of the choices below CANNOT be heard on a hydrophone. Which one is it?

Earthquakes

Marine mammals such as whales and dolphins

Snowmobiles

● **Jellyfish**

swimming

Parks Canada Agency

Find a fossil trilobite and look at it carefully. Why is it called a trilobite?

It has a big mouth to bite things

● **It has three body parts (lobes)**

The person who found the first one and named it was called Trilob

Roots 2 STEM

What is the most abundant element in the Earth's crust?

Carbon

● **Oxygen (46%)**

Nitrogen

GRADE 5 and over OUR FUTURE!

AirTerra Inc.

What are the ingredients plants need for Photosynthesis to take place?

Carbon Dioxide Water Light ● **All of these**

Canadian Society of Exploration Geophysicists

What are two types of Seismic Waves?

● **P-waves** Tsunamis ● **S-waves** Turbulence

Canadian Space Agency / Agence spatiale canadienne

How far away from Earth do satellites orbit?

50-100 km ● **400- 36000 km** 10 000-100 000 km

Earth Stories

What killed all the dinosaurs?

● **A Meteorite impact** A disease Human activity

Energy Production and Transmission Canadian Geographic Giant Floor Map

Most oil and natural gas is transported from Alberta to the rest of Canada and the USA by

Trains Trucks Airplanes ● **Pipelines**

Evict Radon

Radon is the leading cause of which type of cancer?

Skin ● **Lung** Liver Stomach

Journey 2050

What is it called when you grow plants without soil?

Indoor gardening Aquaculture ● **Hydroponics**

Lafarge Canada Inc.

What natural processes would help to deposit sand and gravel?

Glaciers Rivers Wind ● **All of these**

Rothney Astrophysical Observatory

What is a satellite?

● **A human-made machine that orbits the earth** An asteroid A meteorite

Royal Astronomical Society of Canada

Which is the one *incorrect* answer to "Why are impact craters more common on the Moon than on the Earth even though both bodies sit within the inner Solar System?"

Most smaller asteroids and comets burn up in the Earth's atmosphere before hitting the surface but the Moon has no atmosphere to do this

There is essentially no erosion on the Moon and thus just about any impact can be preserved forever

● **The Moon's compact size means that its gravity is stronger than that of the Earth**

Plate tectonics on Earth helps erase some older craters

Women in Science and Engineering (WISE)

Which of the following do you think is a non-Newtonian fluid? (particles that are suspended/'stuck'?)

Water ● **Paint** Oil Rubbing Alcohol

Supplemental Questions

AirTerra Inc.

What do plants make from carbon dioxide, water, and light when photosynthesis takes place?

Sugar

What do plants make their body parts from?

Sugar

What happens to plants when they decompose?

CO₂ is released back into the atmosphere.

How can carbon (made from CO₂ from the atmosphere) that is stored by plants in their body parts be prevented from going back into the atmosphere as CO₂ (this is the natural carbon cycle)?

Convert dead plants into charcoal and use it to enhance soil properties for other living plants. In so doing, carbon (otherwise returning to CO₂ in the atmosphere) is stored in soil for 100's to 1000's of years. This is the concept being used when biochar is made and stored in soils to draw CO₂ out of the atmosphere as a climate change mitigation strategy.

Calgary Rock and Lapidary Club

Choose common rocks found in the Calgary area.

Quartzite, Shale, Limestone, Coal (all of these)

Canadian Nuclear Society

What is the worlds largest active nuclear power plant?

Bruce Nuclear Generating Station in Ontario at 6,200 megawatts. Japans Kashiwazaki-Kariwa is larger at 8,000 Megawatts and is scheduled to restart two of its reactors in April of this year. The plant was shut down following the March 2011 Tohoku quake and tsunami. Kashiwazaki- Kariwa won't reclaim its crown from Canada until all units are fully operational again, a date for which has not been set.

https://en.wikipedia.org/wiki/Bruce_Nuclear_Generating_Station

https://en.wikipedia.org/wiki/Kashiwazaki-Kariwa_Nuclear_Power_Plant

What are the advantages of CANDU reactors?

CANDUs do not require large single unit pressure vessels which currently can only be built by Japan and Russia. CANDU doesn't require enriched fuel which is expensive to make and tightly controlled to prevent nuclear weapons proliferation. And CANDU are the only western reactors than can be refueled without shutting the reactor down.

https://en.wikipedia.org/wiki/CANDU_reactor

Are nuclear reactors potential terrorist targets?

Nuclear plants are actually very low on terrorist hit lists. Nuclear reactors in the west are hardened against a number of threats. Six foot thick steel reinforced concrete containment domes are standard across US and Canadian designs. Tests conducted by the US government showed these reactor shells couldn't even be penetrated by a 9/11 style terror attack using hijacked aircraft in suicide attacks. Here in Canada, the security team at Bruce Nuclear generating station won the international "SWAT Olympics" held in the United States seven years in a row. Terrorists tend to prefer much softer targets.

<https://www.youtube.com/watch?v=U4wDqSnBJ-k>

<https://www.brucepower.com/bruce-power-nuclear-response-team-claims-seventh-straightspotc-title/>

How safe is the public from radiation from nuclear power?

As safe as anything could possibly get. Only sitting or sleeping next to another human being for one night results in less exposure to radiation than living next to a nuclear plant for a year (sleeping next to a person for two nights will exceed the radiation exposure of living next to a nuclear plant for a year). Eating a single banana results in slightly more radiation exposure than living next to a nuclear power plant. Flying from Vancouver to Toronto results in roughly 400 times the radiation exposure of living next to a nuclear plant. And living next to a coal fired power plant results in 100 times the radiation exposure of living next to a nuclear plant (Alberta has 3500 megawatts of coal fired electrical capacity but no nuclear plants).

<https://xkcd.com/radiation/>

The headline of this Scientific American article is very poorly worded. Coal ash is not more radioactive than spent nuclear fuel. However the text of the article gets it right. Persons living next to coal plants receive approximately 100x as much radiation as persons living next to nuclear plants. Spent nuclear fuel is stored in shielded containers, coal ash is not.

<https://www.scientificamerican.com/article/coal-ash-is-more-radioactive-than-nuclear-waste/>

Department of Geoscience, University of Calgary

Which is the most common rock that forms Earth's crust?

Granite

● **Basalt**

Limestone

Sandstone

Journey 2050

What are the three essential nutrients that a plant needs?

Nitrogen, Phosphorus, and Potassium

What percentage of earth is ideal for growing crops?

3% or 10% of all the land

Ocean Networks Canada

Other types of instruments used by Ocean Networks Canada include: Cameras, Weather stations, seismometers, fluorometers and many others.

Rothney Astrophysical Observatory

What is a way that we capture space junk? Think up the best way to destroy or return old satellites to earth.

What should we do with old satellites that no longer work?

We need to clean up near earth space of old satellites.

Women in Science and Engineering (WISE)

WISE's demo is about Newtonian (new-tow-knee-un) and non-Newtonian fluids. Newtonian fluids are liquids that behave 'normally, such as water. Brainstorm for a minute, how does water behave when you apply pressure to it? Does it easily run through your fingers? Of course it does! Does it become solid or thicker when you splash about in a pool? Of course not! Non-Newtonian fluids are harder to describe than water, including our ooze.

This ooze is made up of small particles of cornstarch that are suspended/ "stuck" floating in the water, not dissolving. When you squish it or poke it, what do you notice? That is right, it changes from liquid to solid! When you touch it, you are applying pressure to the ooze. This pressure forces the cornstarch particles closer together and push the water away. The cornstarch doesn't move as easily and makes the cornstarch thicker/more viscous and act like a solid!

This is what makes our ooze 'non-Newtonian'. Non-Newtonian fluids behave differently under different conditions, including pressure. Some of them, like our ooze, get thicker under pressure while others become runnier.