



Lesson Plan: Weathering of rocks and soil formation

Grade Level: 7

Subject: Earth Science

Duration: 45–60 min

NGSS MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Learning Objectives

By the end of this lesson, students will be able to:

- **Distinguish** mechanical weathering from chemical weathering with examples of each.
- **Explain** how geoscience processes such as water, ice, and wind break rock down and change Earth's surface.



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by water, wind, or ice scrape against it, or as rocks grind against one another.

- **Acid rain:** Rain that contains more acid than normal, formed when gases from burning fossil fuels mix with water, and that speeds up the chemical weathering of rock.
- **Humus:** The dark part of soil made of decayed plant and animal material, which provides nutrients that plants need.
- **Soil:** The loose top layer of Earth's surface, made of small weathered rock pieces mixed with humus, water, and air, in which plants can grow.



Materials Needed: (all links are included in this PDF)

- Printed copies of the Weathering of Rocks and Soil Formation Study Guide (<https://newpathworksheets.com/api/guide/study-guide-science-grade-7-weathering-of-rocks-and-soil-formation-1.pdf>)
- Weathering vocabulary matching worksheet (<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-weathering-of-rocks-and-soil-formation-1-1.pdf>)
- Weathering practice worksheet (mechanical and chemical weathering) (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-7-weathering-of-rocks-and-soil-formation-1-0.pdf>)
- Soil formation practice worksheet (soil horizons) (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-7-weathering-of-rocks-and-soil-formation-1-1.pdf>)
- Sugar cubes and a covered jar to shake and model how abrasion breaks rock into smaller pieces



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Step 2: Direct Instruction (15 minutes)

- Use the Study Guide to explain mechanical weathering (freezing water, abrasion, and root growth) and chemical weathering (acids and oxygen reacting with minerals). (<https://newpathworksheets.com/api/guide/study-guide-science-grade-7-weathering-of-rocks-and-soil-formation-1.pdf>)
- Demonstrate chemical weathering by placing a piece of chalk or limestone in vinegar so students can watch the acid bubble and break the rock down.
- Shake sugar cubes in a covered jar and show how the sharp edges wear away, modeling how abrasion breaks rock into smaller, rounder pieces.



Step 3: Guided Practice (15 minutes)

- Complete the vocabulary matching worksheet together, defining weathering, mechanical weathering, chemical weathering, erosion, abrasion, and acid rain.
(<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-weathering-of-rocks-and-soil-formation-1-1.pdf>)
- Compare a solid piece of rock with one broken into pieces and discuss why smaller pieces have more surface area and weather faster.
- Use a labeled soil-horizon diagram to trace how weathered rock and humus build up into the A, B, and C horizons of soil.

Step 4: Independent Practice (12 minutes)

- Have students complete the practice worksheet on mechanical and chemical weathering, sorting examples such as frost, acid rain, and abrasion.
(<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-7-weathering-of-rocks-and-soil-formation-1-0.pdf>)



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💡 Differentiation Strategies

For advanced learners:

- Challenge students to explain why the same type of rock weathers faster in a warm, wet climate than in a cold, dry one, using the idea of chemical weathering rates.
- Have students order a set of weathering and soil-formation steps to explain how bare rock becomes fertile soil over time.

For learners needing support:



- Provide a picture sort with photographs of weathering examples already grouped under 'mechanical' and 'chemical' headings for students to study before sorting on their own.
- Give students a pre-labeled soil-horizon diagram to reference while completing the soil formation worksheet.

Extension Activities

- Have students place identical pieces of chalk in water, vinegar, and salt water for several days and compare how quickly each one weathers.
- Have students investigate weathering on local buildings or gravestones and photograph examples of mechanical and chemical weathering.

Complete List of Available Resources:



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- Vocabulary PDF 1 (<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-weathering-of-rocks-and-soil-formation-1-1.pdf>)
- Vocabulary PDF 2 (<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-weathering-of-rocks-and-soil-formation-1-2.pdf>)
- Vocabulary PDF 3 (<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-weathering-of-rocks-and-soil-formation-1-3.pdf>)
- Vocabulary PDF 4 (<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-7-weathering-of-rocks-and-soil-formation-1-4.pdf>)

WEATHERING OF ROCKS AND SOIL

Weathering is a collection of natural processes that, over time, break large rock into smaller and smaller pieces. Rocks can be decomposed, that is, broken down, by physical processes (called **mechanical weathering**) and chemical processes (called **chemical weathering**). When a piece of rock of any size moves during weathering, the process is then called **erosion**. When the force of gravity pulling material downhill causes erosion, it is called **mass wasting**.

Mechanical Weathering

Mechanical weathering is the physical decomposition of rocks. There are a number of physical processes that break rock down into smaller and smaller pieces.

1. Mechanical weathering can happen by the **abrasion** of one rock



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Running water rolls rock pieces against each other, breaking the rocks down and polishing their edges.

5. Glaciers break rocks apart and crush rocks against each other as they move from higher to lower elevations.

6. Ocean waves pound against coastal rocks. The force of the waves themselves slowly breaks down the rock formations. The waves also push smaller pieces of rock and other debris against larger rocks, grinding both into smaller pieces.
7. Wind blows small particles against rocks which slowly sands the rocks down, much like sandpaper sands wood.

Lesson Checkpoint: Name two ways that mechanical weathering wears down rock.

Chemical Weathering

Chemical weathering is the decomposition of rocks by chemical reactions. The chemicals can be from natural sources, such as the decomposition of sulfide minerals like pyrite. In modern times, the chemicals can also be the byproduct of pollution created by the



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substrate and also find nutrition. This acid is strong enough to decompose rock.

5. Many minerals are relatively unstable and easily deteriorate in the presence of water and natural chemicals. Feldspar in granite, for example, breaks down into clay.

Lesson Checkpoint:
Describe one type of chemical weathering.

How Does Soil Form?

Soil is a combination of decomposed rock and organic materials. There are different types of soil depending on the climate in which they form. Geologists study soil by studying the **soil profile**. The soil profile is a cross-section of the soil from the surface down to the hard **bedrock** (also called **parent rock**). The soil profile is subdivided into **horizons**. The uppermost is the A horizon and consists primarily of decaying organic material. (Sometimes the A horizon is broken into the O horizon on top of the A horizon below.) This material is called **humus**. The B horizon is also called the **subsoil**. The C horizon contains partially decomposed bedrock or parent rock material. Below the C horizon is unaltered parent rock.



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material is usually mostly plant material, but it can also be animal remains as well.

As water percolates down through the soil horizon, it leaches nutrients and minerals from the surface and moves them downward into the lower soil horizons. The C horizon, however, is generally devoid of nutrients.

Lesson Checkpoint:
Which layer of soil has no nutrients?

Types of Soil

The physical characteristics of the soil that forms in any particular region is determined by the region's climate.

1. **Tropical regions** have dense vegetation and high rainfall. The topsoil in tropical regions is very thin because the high rainfall constantly and quickly leaches the topsoil.
2. **Desert climates** have very low rainfall. The little rain that does fall generally evaporates quickly. Soluble minerals that are dissolved in the rainwater are then easily left behind. This is a harsh environment for plants to survive, so there is very little vegetation. Desert soil, therefore, has little to no humus and cannot support much plant life.
3. **Temperate climates** have the most nutrient-rich, productive soils in the world. They have a thick humus layer. They get



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material. Animals make their homes in the soil where they live, breed and find protection from predators. Burrowing animals also help create the soil profile by breaking up lower horizons and helping break down hard dirt, soil and rock.

Soil conservation

Soil is essentially a nonrenewable resource. Without careful use, it can be easily and quickly depleted and even destroyed. For example, in the 1920's, farmers in states like Kansas were devastated by a series of events that resulted in the topsoil literally being blown away by the wind in tremendous clouds of dust. Historians call this "The Great Dustbowl." This problem was created by the widespread removal of the grasses that grew on the topsoil (called **cover crops**) which allowed considerable erosion.

The dramatic removal of cover crops, like grasses and wildflowers, will lead to rapid erosion of the topsoil. Since the topsoil holds considerable quantities of water, loss of this natural "sponge" can lead to dramatic flooding. Similarly, water management can become a problem when an area is overdeveloped with homes, businesses, parking lots and roads. When the soil is removed or covered, the water that would have been held by the soil now must



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Weathering of Rocks

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Weathering is a collection of natural processes that, over time, break large rock into smaller and smaller pieces.

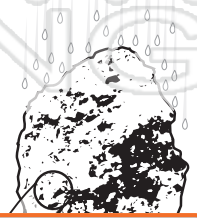
Mechanical weathering is the **physical decomposition** of rocks. There are a number of physical processes that break rock down into smaller and smaller pieces.

Abrasion

The physical grinding of rock fragments is **abrasion**. Wind blows sediment against rocks which slowly sands the rocks down.

Chemical weathering is the decomposition of rocks by chemical reactions. The three main chemical reactions that decompose rocks are **acid reactions**, **hydrolysis**, and **oxidation**.

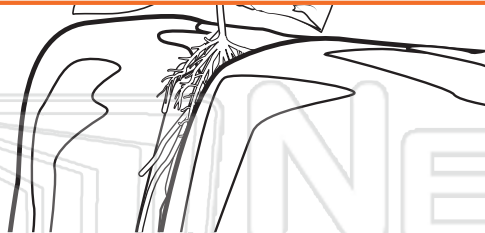
In the presence of water and natural chemicals, feldspar in granite changes to



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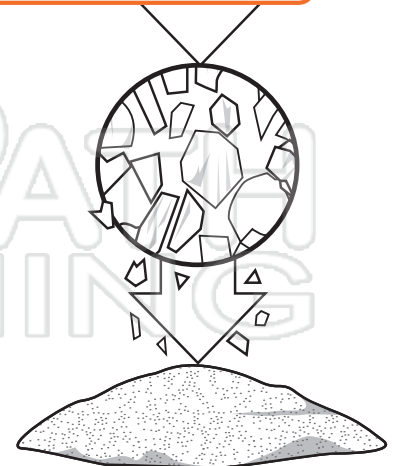
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Plant Roots can grow in cracks and pry the rocks apart.



Freezing & Thawing

Repeated expanding and contracting due to temperature changes can cause some rocks to flake apart at the surface. This process is called **exfoliation**.





Soil Formation

Name _____ Class _____ Date _____

Soil is a combination of **decomposed rock** and **organic materials**. There are different types of soil depending on the climate in which they form. Geologists study soil by studying the **soil profile**. The **soil profile** is a cross-section of the soil and is subdivided into **horizons**.

A horizon is the uppermost layer and consists primarily of **top soil** - decaying organic material.

B horizon is also known as the **subsoil**.

C horizon contains partially **decomposed bedrock**.

The **bedrock** is a layer of **solid rock**. All soil begins with this bedrock.



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bedrock

Step 1

Mechanical and chemical processes **weather** the **bedrock** and turn it into **soil** particles that form the **C horizon**.

Step 2

The **A horizon** layer forms as plants grow adding **organic material** to the soil and breaking up the rocks further.

Step 3

The **B horizon** forms as clay and other **soil** particles percolate downward from the **A horizon**.



Weathering of Rocks

Name _____ Class _____ Date _____

Describe the different types of weathering that break large rock into smaller and smaller pieces.

Mechanical weathering: _____

Chemical weathering: _____

Abra

Plant

Exfol

Com



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Soil Formation

Name _____ Class _____ Date _____

Fill in the blanks. Describe how soil forms in the spaces below.

A horizon is the _____ layer and consists primarily of _____ - decaying _____ material.

B horizon is also known as the _____.

C horizon contains partially decomposed _____.

The _____ is a layer of solid rock.



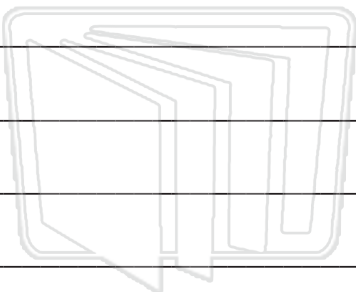
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Step 1

Step 2

Step 3



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Weathering of Rocks

Answer Key

Describe the different types of weathering that break large rock into smaller and smaller pieces.

Mechanical weathering: is the physical decomposition of rocks. There are a number of physical processes that break rock down into smaller and smaller pieces.

Chemical weathering: is the decomposition of rocks by chemical reactions. The three main chemical reactions that decompose rocks are acid reactions, hydrolysis, and oxidation.



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open-ended





Soil Formation

Answer Key

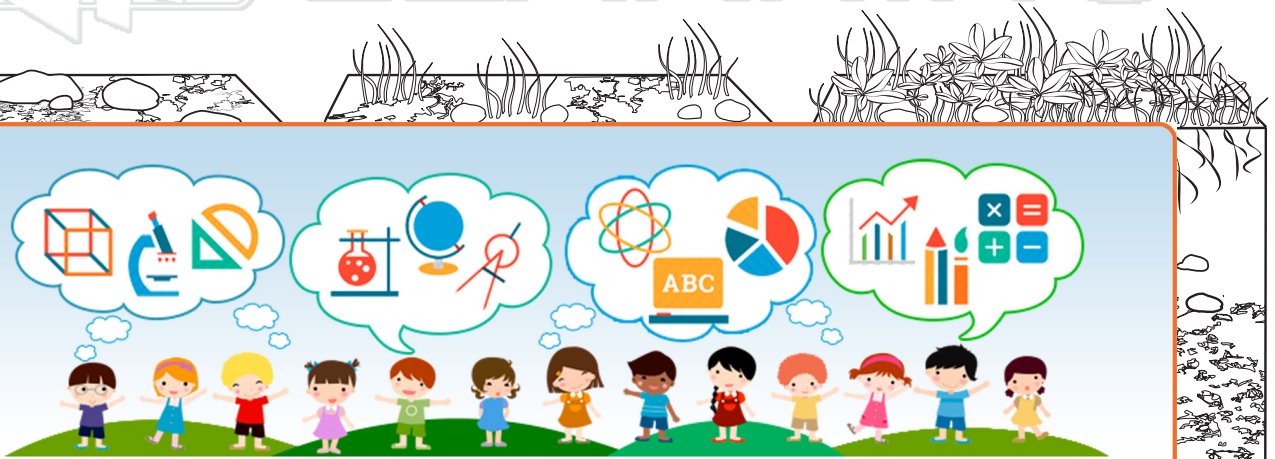
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Step 1

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bedrock and turn it into
soil particles that form
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A horizon layer forms
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Step 3

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Name _____ Class _____ Date _____

1

_____ refers to the natural processes that **break** rock into **smaller** and **smaller** pieces.

- A Subduction
- B Weathering
- C Oxidation
- D Erosion



2

Which of the following is an example of the **chemical weathering** of rock?

- A blowing sand
- B freezing and thawing
- C acid rain
- D burrowing animals

3

Which of the following is an example of the **mechanical weathering** of rock?

- A acid rain
- B running water in a stream
- C oxidation
- D acids from living



4

Acid precipitation contains a number of different acids which form when the **water** reacts with air born **pollution**. Which two acids are most common in **acid precipitation**?

- A hydrochloric acid and sulfuric acid
- B hydrochloric acid



5



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7

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9

Decide if the following is true or false: Weathering depends on location. Compared to the foot of a mountain, the temperature changes are more extreme at the top, heating and freezing rock more often. There are more windblown particles and stronger winds. There is also more rain, so more chemical weathering occurs.

Rock weathers faster on the top of a mountain.

True or false?

- A true
- B false



10

The part of soil that is composed of **decayed biological matter** is called _____.

- A parent rock
- B residual soil
- C humus
- D transported soil



Name _____ Class _____ Date _____

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C

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C

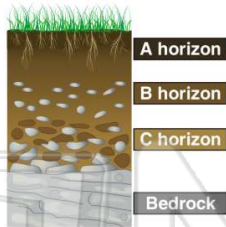


Name _____ Class _____ Date _____

1

The soil layer that contains **dissolved substances** and **clay** is _____.

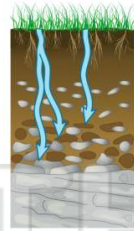
- A** horizon A
- B** horizon B
- C** horizon C
- D** bedrock

**2**

As **water moves down** through a soil horizon, it dissolves minerals and other substances from the upper layers and moves them downward.

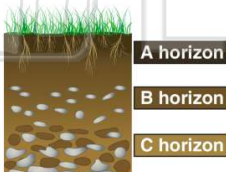
This process is called _____.

- A** weathering
- B** slumping
- C** leaching
- D** dissolving

**3**

The soil horizon that contains **partially broken up** bedrock and very **low** amount of **nutrients** is _____.

- A** horizon A

**4**

It is surprising to discover that in a **tropical** environment, the **topsoil** is very **thin**.

Why does this occur?

- A** rich vegetation has unusually long life spans
- B** high rainfall leaches away the topsoil
- C** nutrient-rich topsoil is absorbed by the

**5**

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9

Soil is **important** for all of these reasons **except** _____.

- A** it is a source of housing for many organisms
- B** it stores tremendous amounts of water
- C** it is often an important source of ores like iron ore (hematite)
- D** it is a source of nutrients for plants, animals, and humans

10

In the 1930s, farmers in the Great Plains were devastated by a **series** of events that resulted in the **topsoil** literally being **blown away** by the wind in tremendous clouds of **dust**.

Which **factor** contributed to what historians call the **Great Dust Bowl**?

- A** too much water
- B** daylight savings time
- C** widespread removal of plants and grasses
- D** forest fires



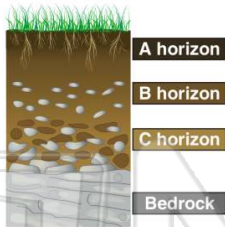


Name _____ Class _____ Date _____

1

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- C horizon C
- D bedrock



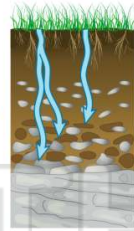
B

2

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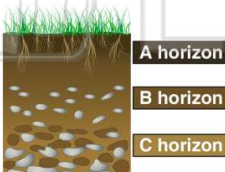


C

3

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C

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B

5



B

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B

9

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- A too much water
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- C widespread removal of plants and grasses
- D forest fires



C



Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Chemical weathering

Erosion

Weathering

Alpine glacier

Alluvial fan

Acid precipitation

Acid rain

Abrasion

1. _____ - the natural processes that break large rock into smaller and smaller pieces

2. _____ - a process by which weathered rock and soil is transported to a new location; the wearing away of the Earth's surface by rain, wind, snow and ice

3. _____
one ro

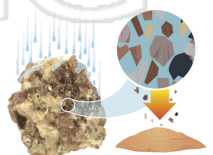
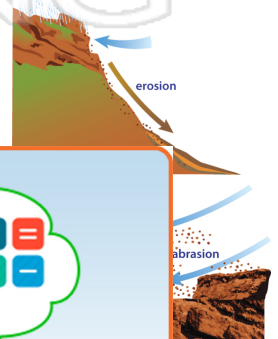
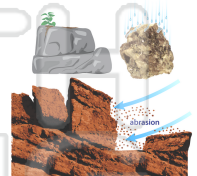
4. _____
precip
put int

5. _____
causes

6. _____
mount

7. _____ - a moving mass of ice that forms at high altitudes on mountains; also called valley glaciers

8. _____ - the breaking down of rock by chemical reactions



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Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Chemical weathering

Erosion

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Alluvial fan

Acid precipitation

Acid rain

Abrasion

1. weathering - the natural processes that break large rock into smaller and smaller pieces

2. erosion - a process by which weathered rock and soil is transported to a new location; the wearing away of the Earth's surface by rain, wind, snow and ice

3. abrasion - the process by which rocks and soil are worn away by friction against each other

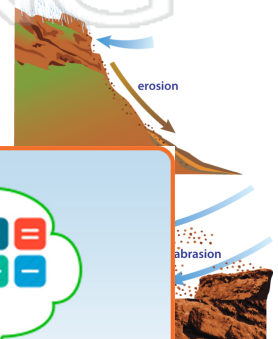
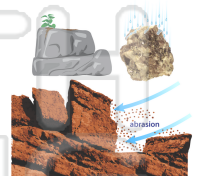
4. acid precipitation - rain or snow that is acidic due to the presence of sulfuric or nitric acid

5. acid rain - rain or snow that is acidic due to the presence of sulfuric or nitric acid

6. alluvial fan - a fan-shaped deposit of sediment that forms at the base of a mountain or hill, where a stream or river exits a narrow valley

7. alpine glacier - a moving mass of ice that forms at high altitudes on mountains; also called valley glaciers

8. chemical weathering - the breaking down of rock by chemical reactions



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