

**Grade 8**  
**Assignment Bundle**

Name: \_\_\_\_\_ Class: \_\_\_\_\_

# More Facebook Friends, Fewer Real Ones, Says Cornell Study

By ABC News  
November 8, 2011

*Matthew Brashears, a Cornell University sociologist, surveyed more than 2,000 adults and concluded that despite the emergence of online social networks, the number of truly close friends people cite has dropped. As you read, take note of the different factors that have contributed to this.*

- [1] We may “friend” more people on Facebook, but we have fewer real friends – the kind who would help us out in tough times, listen sympathetically no matter what, lend us money or give us a place to stay if we needed it, keep a secret if we shared one.

That’s the conclusion made by Matthew Brashears, a Cornell University sociologist who surveyed more than 2,000 adults from a national database and found that from 1985 to 2010, the number of truly close friends people cited has dropped – even though we’re socializing as much as ever.



*"Friends with Mobile Phones" by Garry Knight is licensed under CC BY 2.0.*

On average, participants listed 2.03 close friends in Brashears’ survey. That number was down from about three in a 1985 study.

“These are the people you think of as your real confidants,<sup>1</sup> your go-to people if you need something,” Brashears said.

- [5] Brashears asked people online from a database called TESS – Time-Sharing Experiments for the Social Sciences – to list the names of people with whom they had discussed “important matters” over the previous six months. He reports the results in a forthcoming issue of the journal *Social Networks*.

Forty-eight percent of participants listed one close friend when asked, 18 percent listed two and 29 percent listed more. A little more than 4 percent didn’t list anyone.

What’s going on? Brashears said his survey can’t tell us conclusively, but his guess is that while we meet just as many people as we used to, we categorize them differently.

1. **Confidant (noun):** a trusted friend or partner

Does that mean we're more isolated in these times when we seem to meet more people online than in person? (How many of your Facebook "friends" are really friends of yours?) Defying<sup>2</sup> some of the stereotypes of the digital age, social scientists say Facebook may actually be healthy for us. Keith Hampton at the Annenberg School for Communication at the University of Pennsylvania wrote a report for the Pew Research Center in which he found that "Internet users in general, but Facebook users even more so, have more close relationships than other people."

"Facebook users get more overall social support, and in particular they report more emotional support and companionship than other people," wrote Hampton in a blog post. "And, it is not a trivial amount of support. Compared to other things that matter for support – like being married or living with a partner – it really matters. Frequent Facebook use is equivalent to about half the boost in support you get from being married."

[10] But online contact and personal contact are different. While Hampton reports we know more people because of Facebook and similar sites, Brashears reports there are fewer whom we choose to trust with our most intimate worries.

"We're not becoming asocial," said Brashears, "but these people give us social support, and they give us advice."

*"More Facebook Friends, Fewer Real Ones, Says Cornell Study" from www.abcnews.com, © ABC News. Reprinted with permission, all rights reserved.*

## Text-Dependent Questions

**Directions:** For the following questions, choose the best answer or respond in complete sentences.

1. Summarize the central idea(s) of the article.

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2. PART A: What does the word “confidant” most closely mean as it is used in paragraph 4?

- A. Someone with a lot of self-esteem
- B. An acquaintance or colleague
- C. Someone you might take advantage of
- D. A person you deeply trust and care about

3. PART B: Which phrase from the text provides the best support for the answer to Part A?

- A. “truly close friends” (Paragraph 2)
- B. “socializing as much as ever” (Paragraph 2)
- C. “if you need something” (Paragraph 4)
- D. “discussed ‘important matters’” (Paragraph 5)

4. Why does the author quote Keith Hampton? What is the purpose for including his views?

- A. To suggest that the results of the Cornell study are flawed and should be taken lightly.
- B. To provide the alternative perspective that social networks like Facebook may be more helpful than harmful.
- C. To support the central idea of the text that people should carefully consider the costs and benefits of social media.
- D. To introduce the point that social network relationships are less valuable than real ones.

5. What is the difference between online contact and personal contact? Why is this an important distinction?

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## Discussion Questions

**Directions:** *Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.*

1. Consider Matthew Brashears' method of collecting data. Do you believe these methods are valid? Are there any problems? What conclusions can you draw?
2. In your own experience, do social networks make us more or less social? Explain.
3. Do you believe that Facebook and other social networks are making us redefine friendship? Explain your answer.
4. In your opinion, what is a friend? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.
5. In the context of this text, what are the costs and benefits of technology? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.
6. In the context of this article, how are communities formed? Do sites like Facebook help people more easily form communities? What impact, if any, have online communities had on current or past events? Cite evidence from this text, your own experience, and other literature, art, or history in your answer.

Name: \_\_\_\_\_ Class: \_\_\_\_\_

## After Twenty Years

By O. Henry  
1905

*William Sydney Porter (1862-1910) was an American writer better known by his pen name, O. Henry. "After Twenty Years," published in 1908, is one of his better known short stories that shows how complicated friendship can be.*

*As you read, take notes on the imagery used in the story.*

- [1] The policeman on the beat moved up the avenue impressively. The impressiveness was habitual and not for show, for spectators<sup>1</sup> were few. The time was barely 10 o'clock at night, but chilly gusts of wind with a taste of rain in them had well nigh depeopled the streets.

Trying doors as he went, twirling his club with many intricate and artful movements, turning now and then to cast his watchful eye adown the pacific thoroughfare, the officer, with his stalwart form and slight swagger, made a fine picture of a guardian of the peace. The vicinity was one that kept early hours. Now and then you might see the lights of a cigar store or of an all-night lunch counter; but the majority of the doors belonged to business places that had long since been closed.

When about midway of a certain block the policeman suddenly slowed his walk. In the doorway of a darkened hardware store a man leaned, with an unlighted cigar in his mouth. As the policeman walked up to him the man spoke up quickly.

"It's all right, officer," he said, reassuringly. "I'm just waiting for a friend. It's an appointment made twenty years ago. Sounds a little funny to you, doesn't it? Well, I'll explain if you'd like to make certain it's all straight. About that long ago there used to be a restaurant where this store stands — 'Big Joe' Brady's restaurant."

- [5] "Until five years ago," said the policeman. "It was torn down then."



*"Night Walk" by Matthias Ripp is licensed under CC BY 2.0*

1. **Spectator (noun):** someone who looks on or watches (a performance or other public event)

The man in the doorway struck a match and lit his cigar. The light showed a pale, square-jawed face with keen eyes, and a little white scar near his right eyebrow. His scarfpin was a large diamond, oddly set.

"Twenty years ago to-night," said the man, "I dined here at 'Big Joe' Brady's with Jimmy Wells, my best chum, and the finest chap in the world. He and I were raised here in New York, just like two brothers, together. I was eighteen and Jimmy was twenty. The next morning I was to start for the West to make my fortune. You couldn't have dragged Jimmy out of New York; he thought it was the only place on earth. Well, we agreed that night that we would meet here again exactly twenty years from that date and time, no matter what our conditions might be or from what distance we might have to come. We figured that in twenty years each of us ought to have our destiny worked out and our fortunes made, whatever they were going to be."

"It sounds pretty interesting," said the policeman. "Rather a long time between meets, though, it seems to me. Haven't you heard from your friend since you left?"

"Well, yes, for a time we corresponded," said the other. "But after a year or two we lost track of each other. You see, the West is a pretty big proposition,<sup>2</sup> and I kept hustling around over it pretty lively. But I know Jimmy will meet me here if he's alive, for he always was the truest, staunchest<sup>3</sup> old chap in the world. He'll never forget. I came a thousand miles to stand in this door to-night, and it's worth it if my old partner turns up."

[10] The waiting man pulled out a handsome watch, the lids of it set with small diamonds.

"Three minutes to ten," he announced. "It was exactly ten o'clock when we parted here at the restaurant door."

"Did pretty well out West, didn't you?" asked the policeman.

"You bet! I hope Jimmy has done half as well. He was a kind of plodder,<sup>4</sup> though, good fellow as he was. I've had to compete with some of the sharpest wits going to get my pile. A man gets in a groove in New York. It takes the West to put a razor-edge on him."

The policeman twirled his club and took a step or two.

[15] "I'll be on my way. Hope your friend comes around all right. Going to call time on him sharp?"

"I should say not!" said the other. "I'll give him half an hour at least. If Jimmy is alive on earth he'll be here by that time. So long, officer."

"Good-night, sir," said the policeman, passing on along his beat, trying doors as he went.

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2. **Proposition (noun):** something (such as a plan or offer) that is presented to a person or group of people to consider  
3. Perhaps a form of "staunch," meaning of strong construction or conviction.  
4. a person who works in a slow, uninspired manner; a person who plods



There was now a fine, cold drizzle falling, and the wind had risen from its uncertain puffs into a steady blow. The few foot passengers astir in that quarter hurried dismally<sup>5</sup> and silently along with coat collars turned high and pocketed hands. And in the door of the hardware store the man who had come a thousand miles to fill an appointment, uncertain almost to absurdity, with the friend of his youth, smoked his cigar and waited.

About twenty minutes he waited, and then a tall man in a long overcoat, with collar turned up to his ears, hurried across from the opposite side of the street. He went directly to the waiting man.

[20] "Is that you, Bob?" he asked, doubtfully.

"Is that you, Jimmy Wells?" cried the man in the door.

"Bless my heart!" exclaimed the new arrival, grasping both the other's hands with his own. "It's Bob, sure as fate. I was certain I'd find you here if you were still in existence. Well, well, well! — twenty years is a long time. The old restaurant's gone, Bob; I wish it had lasted, so we could have had another dinner there. How has the West treated you, old man?"

"Bully; it has given me everything I asked it for. You've changed lots, Jimmy. I never thought you were so tall by two or three inches."

"Oh, I grew a bit after I was twenty."

[25] "Doing well in New York, Jimmy?"

"Moderately. I have a position in one of the city departments. Come on, Bob; we'll go around to a place I know of, and have a good long talk about old times."

The two men started up the street, arm in arm. The man from the West, his egotism enlarged by success, was beginning to outline the history of his career. The other, submerged in his overcoat, listened with interest.

At the corner stood a drug store, brilliant with electric lights. When they came into this glare each of them turned simultaneously<sup>6</sup> to gaze upon the other's face.

The man from the West stopped suddenly and released his arm.

[30] "You're not Jimmy Wells," he snapped. "Twenty years is a long time, but not long enough to change a man's nose from a Roman to a pug."

"It sometimes changes a good man into a bad one," said the tall man. "You've been under arrest for ten minutes, 'Silky' Bob. Chicago thinks you may have dropped over our way and wires us she wants to have a chat with you. Going quietly, are you? That's sensible. Now, before we go on to the station here's a note I was asked to hand you. You may read it here at the window. It's from Patrolman Wells."

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5. **Dismal** (*adjective*): showing or causing sadness; very bad or poor

6. **Simultaneously** (*adverb*): happening at the same time

The man from the West unfolded the little piece of paper handed him. His hand was steady when he began to read, but it trembled a little by the time he had finished. The note was rather short.

"Bob: I was at the appointed place on time. When you struck the match to light your cigar I saw it was the face of the man wanted in Chicago. Somehow I couldn't do it myself, so I went around and got a plain clothes man to do the job. JIMMY."

*"After Twenty Years" by O. Henry (1905) is in the public domain.*

## Text-Dependent Questions

**Directions:** For the following questions, choose the best answer or respond in complete sentences.

1. PART A: What does the word “stalwart” most closely mean as it is used in paragraph 2?
  - A. Loyal and dedicated
  - B. Rude and arrogant
  - C. Threatening and scary
  - D. Awkward and rigid
  
2. PART B: Which of the following phrases from paragraph 2 best supports the answer to Part A?
  - A. “Trying doors as he went, twirling his club”
  - B. “with many intricate and artful movements”
  - C. “cast his watchful eye adown the pacific thoroughfare”
  - D. “a fine picture of a guardian of the peace”
  
3. PART A: Which of the following best describes a central theme of the text?
  - A. Those who fight for justice will always be rewarded.
  - B. Loyalty is absolute and must allow no room for disagreement.
  - C. The decision between loyalty and doing what is right is a hard one to make.
  - D. Money can help one make new friends, but not old.
  
4. PART B: Which of the following quotes best supports the answer to Part A?
  - A. “The policeman on the beat moved up the avenue impressively. The impressiveness was habitual and not for show, for spectators were few.” (Paragraph 1)
  - B. “But I know Jimmy will meet me here if he's alive, for he always was the truest, stanchest old chap in the world. He'll never forget.” (Paragraph 9)
  - C. “The man from the West, his egotism enlarged by success, was beginning to outline the history of his career.” (Paragraph 27)
  - D. “When you struck the match to light your cigar I saw it was the face of the man wanted in Chicago. Somehow I couldn't do it myself, so I went around and got a plain clothes man to do the job.” (Paragraph 33)

5. Consider the imagery used in the story around darkness and light. Why is this imagery important?

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## Discussion Questions

**Directions:** *Brainstorm your answers to the following questions in the space provided. Be prepared to share your original ideas in a class discussion.*

1. Is this a strong friendship? How do you know?
2. How can morality (doing the right thing) complicate friendship?
3. Would you have done with Jimmy did to Bob? Why or why not?
4. In the context of this story, what is a friend? Use evidence from this text, your own experience, and other art, literature, or history in your answer.

## Informational Writing Prompt and Checklist Grades 6-9

**Writing Prompt:** You have just read two texts about friendship. Write an informational essay explaining what it means to be a friend.

**Be sure to:**

- Plan your writing using the two texts and your responses to the two discussion questions from each text.
- Use the checklist as a guide for organizing and writing your essay.

**Writing Checklist**

<b>Introduction</b>	<input type="checkbox"/> Introduces the topic <input type="checkbox"/> Provides a thesis statement that addresses the prompt
<b>Body</b>	<input type="checkbox"/> Structures a logical progression of ideas in multiple paragraphs that support the thesis statement <input type="checkbox"/> Includes transitions to clarify relationship between and among ideas <input type="checkbox"/> Cites at least two pieces of evidence from Text 1 that most strongly supports the ideas <input type="checkbox"/> Elaborates and explains how each piece of text evidence supports the topic and ideas <input type="checkbox"/> Cites at least two pieces of evidence from Text 2 that most strongly supports the ideas <input type="checkbox"/> Elaborates and explains how each piece of text evidence supports the topic and ideas
<b>Conclusion</b>	<input type="checkbox"/> Restates key ideas <input type="checkbox"/> Ends with an effective closure for audience and purpose
<b>Entire Essay</b>	<input type="checkbox"/> Has few errors in sentence formatting, capitalization, punctuation, and spelling.

## Selecting Books for Your Child: Finding 'Just Right' Books

By: Kathleen Rogers

How can parents help their children find books that are not "too hard" and not "too easy" but instead are "just right"? Here's some advice.

### Five finger rule

1. Choose a book that you think you will enjoy.
2. Read the second page.
3. Hold up a finger for each word you are not sure of, or do not know.
4. If there are five or more words you did not know, you should choose an easier book.
5. Still think it may not be too difficult? Use the five finger rule on two more pages.

### Choose a book that is a good fit for you!

Read two or three pages and ask yourself these questions:

#### Will it be an easy, fun book to read?

- Do I understand what I am reading?
- Do I know almost every word?
- When I read it aloud, can I read it smoothly?
- Do I think the topic will interest me?

If most of your answers were "yes", this will be an easy book to read independently by yourself.

#### Will this book be too hard for me?

- Are there five or more words on a page that I don't know, or am unsure of?
- Is this book confusing and hard to understand by myself?
- When I read it aloud, does it sound choppy and slow?

If most of your answers were "yes," this book is too hard. You should wait awhile before you read this book. Give the book another try later, or ask an adult to read the book to you.

### Tips on reading with your child

- When they can't read the word, say...
- Can you sound it out?
- Fingertap it.
- Can you think of the word or movement that helps you remember that vowel sound?
- What is the first and last sound? What word would make sense?
- Does it have a pattern that you have seen in other words? (ex-an, ack)
- How does the word begin?
- You said \_\_\_\_\_. Does that make sense?
- What word would make sense that would start with these sounds?
- Put your finger under the word as you say it.

### When they want to read a book that is too hard, say...

- Let's read it together.
- This is a book you will enjoy more if you save it until you are older — or later in the year.
- [Be honest!] When people read books that are too hard for them, they often skip important parts. You will have more fun with this book if you wait until you can read it easily.

# HERE'S THE IMPACT OF READING 20 MINUTES PER DAY!

A student who reads

20:00

minutes per day

will be exposed to  
**1.8 MILLION**  
words per year  
and scores in  
**90th PERCENTILE**  
on standardized tests

A student who reads

5:00

minutes per day

will be exposed to  
**282,000**  
words per year  
and scores in  
**50th PERCENTILE**  
on standardized tests

A student who reads

1:00

minute per day

will be exposed to  
**8,000**  
words per year  
and scores in  
**10th PERCENTILE**  
on standardized tests

Source: Nagy, Anderson and Herman, 1987



# Home Reading Log

## Student Information

Student Name		Grade Level	
School Name		Teacher	

## Log

Date	Title	Author	Time Spent	Number of Pages Read

## 8.EE Ant and Elephant

### Task

An ant has a mass of approximately  $4 \times 10^{-3}$  grams and an elephant has a mass of approximately 8 metric tons.

- How many ants does it take to have the same mass as an elephant?
- An ant is  $10^{-1}$  cm long. If you put all these ants from your answer to part (a) in a line (front to back), how long would the line be? Find two cities in the United States that are a similar distance apart to illustrate this length.

Note: 1 kg = 1000 grams, 1 metric ton = 1000 kg, 1m = 100 cm, 1km = 1000 m



8.EE Ant and Elephant  
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## Operations with Numbers Expressed in Scientific Notation I

1.  $(5 \times 10^4)^2$

2.  $(2 \times 10^9)^4$

3. 
$$\frac{(1.2 \times 10^4) + (2 \times 10^4) + (2.8 \times 10^4)}{3} =$$

4. 
$$\frac{7 \times 10^{15}}{14 \times 10^9}$$

5. 
$$\frac{4 \times 10^2}{2 \times 10^8}$$

6. 
$$\frac{(7 \times 10^9) + (6 \times 10^9)}{2}$$

7.  $(9 \times 10^{-4})^2$

8.  $(9.3 \times 10^{10}) - (9 \times 10^{10})$

Name: \_\_\_\_\_

8<sup>th</sup> Grade Math

1. Jack solved an equation to the end, and concluded that the equation had infinite solutions. Which of the following could have been Jack's equation?

a)  $x = 0.\bar{7}$

b)  $x = 0$

c)  $7 = 7$

d)  $-7 = 7$

2. Solve for n:  $-8(n - 3) = -8n - 24$

3. Solve for x:  $3(x + 1) - 5x = 12 - (6x - 7)$

4. Write an equation with infinite solutions: \_\_\_\_\_

5. Write an equation with no solutions: \_\_\_\_\_

6. Write an equation with one solution: \_\_\_\_\_

7. Convert this to a mixed number:  $\frac{13}{2}$

8. Convert this to an improper fraction:  $5\frac{1}{2}$

9. A rectangle has a width that is 2 feet longer than four times the length. What is the length of the rectangle if the perimeter is 64 feet? (HINT: Draw a picture and use algebra to solve!)

**Multistep Equations II**

1.  $2(x + 5) = 3(x + 6)$

2.  $3(x + 5) = 4(x + 6)$

3.  $4(x + 5) = 5(x + 6)$

4.  $-(4x + 1) = 3(2x - 1)$

5.  $3(4x + 1) = -(2x - 1)$

6.  $-3(4x + 1) = 2x - 1$

7.  $15x - 12 = 9x - 6$

8.  $\frac{1}{3}(15x - 12) = 9x - 6$

9.  $\frac{2}{3}(15x - 12) = 9x - 6$

**Multistep Equations I****Set 1:**

$$3x + 2 = 5x + 6$$

$$4(5x + 6) = 4(3x + 2)$$

$$\frac{3x + 2}{6} = \frac{5x + 6}{6}$$

**Set 2:**

$$6 - 4x = 10x + 9$$

$$-2(-4x + 6) = -2(10x + 9)$$

$$\frac{10x + 9}{5} = \frac{6 - 4x}{5}$$

**Set 3:**

$$5x + 2 = 9x - 18$$

$$8x + 2 - 3x = 7x - 18 + 2x$$

$$\frac{2 + 5x}{3} = \frac{7x - 18 + 2x}{3}$$

**Multistep Equations III**

1.  $2.5x - 14.8 = 26.7$

2.  $\frac{3}{4}(8x - 12) = \frac{1}{5}(10x + 15)$

3.  $-\frac{1}{5}(2x - 3) = \frac{1}{2}(4 - 3x)$

4.  $3.1(2x - 13.4) = 3.8x - 14.7 + 2.3x$

5.  $\frac{2}{3}x - \frac{4}{5} + \frac{1}{3}x = 3x - \frac{3}{5}$

6.  $4(2.4x - 4.6) = -(2.2 - 3.6x)$

7.  $4(5.9 + 0.8x) = 2(29.5 - 4.3x)$

8.  $\frac{1}{4}\left(\frac{2}{3}x + 4\right) = \frac{3}{4}\left(\frac{1}{3} - \frac{2}{3}x\right)$

9.  $6.5(2.6x + 7.8) = -5.2(-6.5 - 2.6x) + 3.9x$

# Solving 1-Variable Equations - Anchor

## Problem 1

Two students, Pablo and Karla, are solving an equation. The equation and their work is shown below.

$$15 - 3(x - 2) + 6x = 3(13)$$

Pablo's Work	Karla's Work
$15 - 3x + 6 + 6x = 3(13)$	$15 - 3x + 6 + 6x = 39$
$15 + 6 - 3x + 6x = 3(13)$	$-3x + 6x + 15 + 6 = 39$
$21 + 3x = 3(13)$	$3x + 21 = 39$
$3(7 + x) = 3(13)$	$3x = 18$
$7 + x = 13$	$x = 6$
$x = 6$	

- Explain what Pablo and Karla did in each step of their work.
- Are Pablo and Karla correct?

### Guiding Questions

- What did Pablo and Karla do that was similar to each other?
- What did they do that was different?
- Is each new expression they wrote on the left equivalent to the expression before it? Why? What properties are at play?
- Is there more than one way to solve an equation?



# Simulating Physical and Chemical Weathering at Home



How does rock weather the ages? Learn about these physical and chemical processes with a little sweet science! Credit: George Retseck

## **Introduction**

Have you ever visited a canyon or cave and wondered how those formations came to be? Or observed smooth stones by a river or beach? These results are due to a process called weathering. Weathering, or the wearing-away of rock by exposure to the elements, not only creates smooth rocks as well as caves and canyons, but it also slowly eats away at other hard objects, including some statues and buildings. Try this process out on a sugar cube and feel how powerful weathering can be.

## **Background**

Rock might seem permanent, but it is actually constantly being broken down. We often do not notice this process because it happens so slowly. As soon as rock is exposed to the elements it can start being broken down through the process of weathering. Scientists categorize this processes into two groups: physical weathering and chemical weathering.

In this activity you will model physical and chemical weathering with sugar cubes—so you can see it happen before your eyes.

## **Materials**

At least four sugar cubes	Clay (optional)
Water	Spray bottle (optional)
Dark colored paper or countertop	Frosting (optional)
Glass	Nail file (optional)
Dropper	Tray or large dish with sides
Work area that can get wet	(optional)
Towel for cleaning up (optional)	

## **Procedure**

Think of a few ways you can break or pulverize your rock (sugar cube) with mechanical weathering.

Try it out with one of your sugar cubes!

*Did you crush it, smash it or apply another force on it? Can you list examples of how rocks get smashed or crushed in nature?*

Now take two new sugar cubes, and grind one against the other over a dark colored piece of paper or countertop. *What happens? Do you see sugar dust on the paper or countertop? What is happening to your rock (sugar cube)?*

Try rounding the edges of your sugar cube this way. *Does it work?*

Look back at what is left of your sugar cube. *What does it look like? Is it still sugar?*

Now take a new sugar cube. *What are some ways you could break down your rock (sugar cube) with chemical weathering?*

In this activity we'll use water drops to simulate rain. Place the sugar cube in a glass.

Fill your dropper with water, and squeeze a few drops on the sugar cube. Look and feel to observe what happens.

*What do you think will happen if you drop more water on the sugar cube? What do you think would happen if you drop 10 or 100 (or more) drops on the sugar cube? Will it still be a sugar cube? Will it still be sugar?*

Drop more water on your sugar cube. *Where does the sugar go? Can you make the cube disappear completely?*

**Extra:** Place a few sugar cubes in a glass. Cover them with clay. The sugar cubes represent a layer of rock, and the clay represents topsoil. Make a few holes or a crack in the clay so rainwater can seep into the ground and reach the layer of rock. Spray water over your glass, representing rain coming down over your piece of land. *What do you think will happen to your layer of rock? Might caves form? How does this process depend on having different types of materials in the ground?*

**Extra:** Make a sugar-cube sculpture or structure. To glue cubes together, wet one side of the cube and press it against another cube. If you need stronger glue, frosting can do the trick. Make sure your sculpture has some details and sharp edges. A nail file can help you sculpt the cubes. *What do you think will happen to your sculpture when it is exposed to rain?* Place your sculpture on a tray or dish with sides, and use a spray bottle to let it rain over your sculpture. First a little—then more. What happens? Look carefully at the details and edges: Do they change? What will happen eventually after a lot of rain? This is exactly what acidic rain can do to some statues and buildings over time.

### **Observations and Results**

Was breaking a sugar cube by smashing, crushing or grinding it easy? Rock breaks down in a similar way—but a lot more slowly—in nature in this process of physical or mechanical weathering. Forces in nature, such as gravity, wind and even the push of freezing water or plant roots, impact rocks. These forces eventually wear the rock down. The result is smaller pieces of rock—just like you were left with smaller pieces of sugar.

What about your chemical weathering test? Did the sugar cube become weak and eventually dissolve in the drops of water? That happens to some types of rock, too. Some minerals in rock react with liquids or gasses, creating new substances, which are often weaker—and sometimes even dissolve in water. After you applied enough water you probably did not have any sugar cube left as it was carried away with the water. In a similar way rocks can dissolve and be washed away, forming caves.

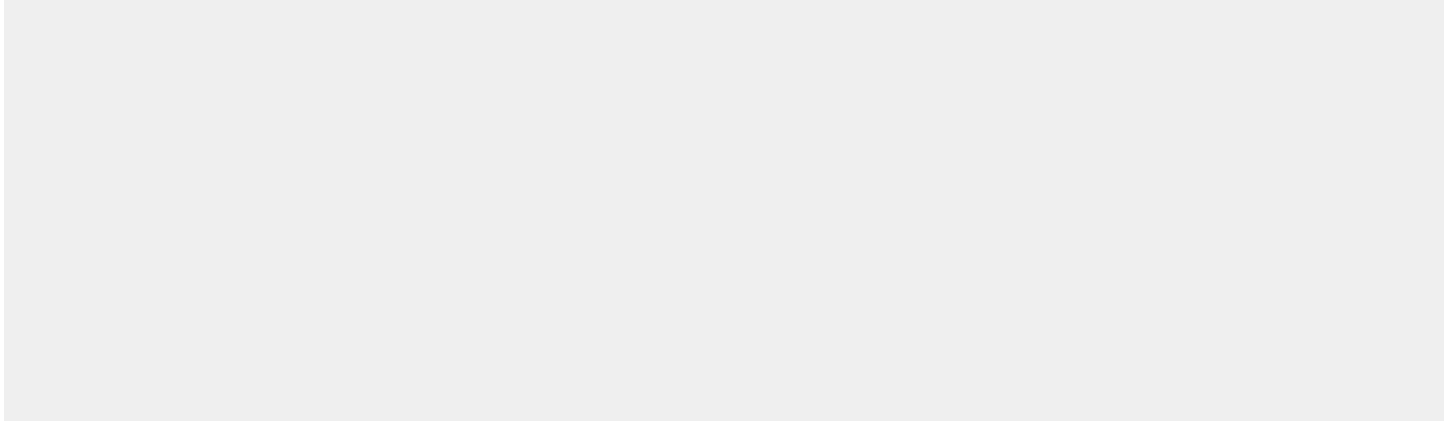
## Assignment #2

How did the Grand Canyon form?

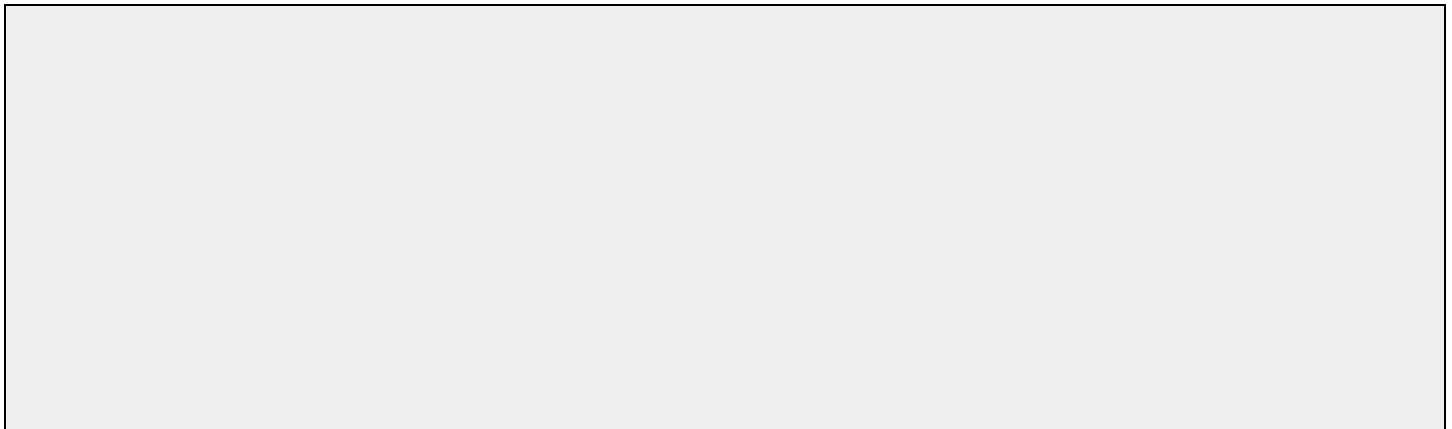
### Part 1

Have you ever seen one of the 7 natural wonders of the world? Today we're going to explore one... the Grand Canyon! Watch the Grand Canyon Video (<https://bit.ly/2V7iUZP>) to see why it's considered a world wonder!

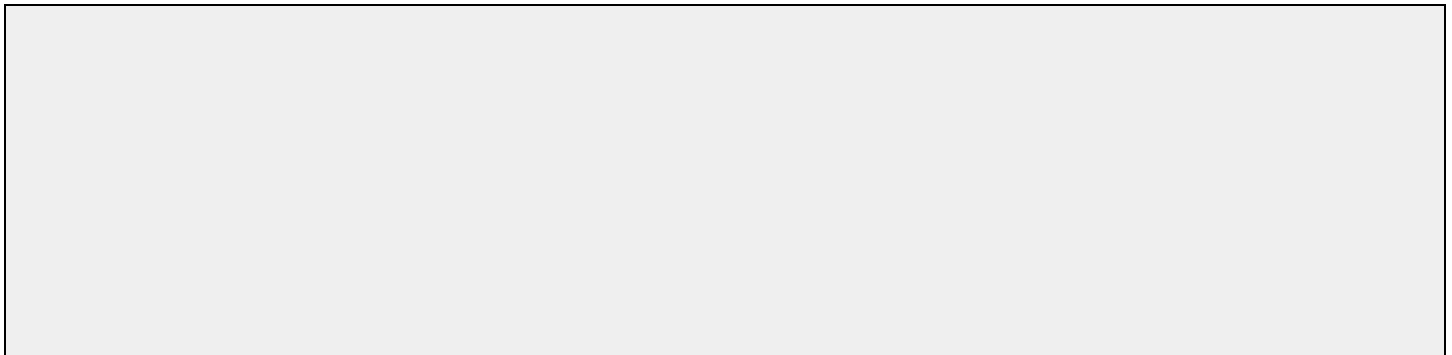
Write at least three observations from the video in the box below.



What are your initial ideas about how the Grand Canyon and other canyons like this form? It's ok if you aren't sure, just share your best ideas so far.



Write one or more questions about the video in the box below.



## Assignment #2

From what type of rock is the Grand Canyon composed?

### Part 2

In order to better understand what kind of weathering broke apart the rock from which the Grand Canyon was formed, it's important to establish what we know about the kind of rocks the Grand Canyon is made from.

- Read Page 1 of the *Grand Canyon Rocks!* article.
- Describe each of the three types of rock using information from the article:
  - Igneous rocks:
  - Sedimentary rocks:
  - Metamorphic rocks:
- Look at the images of the Grand Canyon below. Do you see any clues about what classification of rock the Grand Canyon might be made of? Use what you know about characteristics of different rock classifications and the article information to make an evidence-based claim.



[https://commons.wikimedia.org/wiki/File:USA\\_09855\\_Grand\\_Canyon\\_Luca\\_Galuzzi\\_2007.jpg](https://commons.wikimedia.org/wiki/File:USA_09855_Grand_Canyon_Luca_Galuzzi_2007.jpg)



<https://pixabay.com/images/search/rock%20layers/>

<b>Is the Grand Canyon made of igneous rock, metamorphic rock, or sedimentary rock?</b>	<b>What evidence from the images above supports your claim?</b>
I think the Grand Canyon is composed of....	The evidence that supports my claim is....

- Read pages 2-4 of the *Grand Canyon Rocks!* Article to learn more about the types of rocks found at the Grand Canyon and complete the table below with information about each type of rock.

Rock Name	Time Period Formed?	Environment Description	Types of Fossils Found
<p><b>Precambrian Basement Rocks</b></p> <p>Rock Type: <i>Igneous &amp; Metamorphic</i></p>	<p><i>1.8 billion years ago</i></p>	<p><i>Molten rock flowed as magma through cracks of metamorphic rock</i></p>	<p><i>Hard to find due to heat and pressure during formation</i></p>
<p><b>Bright Angel Shale</b></p> <p>Rock Type: _____</p>			
<p><b>Redwall Limestone</b></p> <p>Rock Type: _____</p>			
<p><b>Supai Group</b></p> <p>Rock Type: _____</p>			
<p><b>Hermit Shale</b></p> <p>Rock Type: _____</p>			
<p><b>Coconino Sandstone</b></p> <p>Rock Type: _____</p>			
<p><b>Kaibab Limestone</b></p> <p>Rock Type: _____</p>			

- Does this information support your earlier answer about the type of rock that composes the Grand Canyon?



# Grand Canyon Rocks!



**How did Grand Canyon form?** By studying **geology** we learn about the Earth's history and how places change over time. What plants or animals lived in your town 150 million years ago? The ancient remains of plants and animals preserved in the rock, called **fossils**, tell stories about the past. Take a look at the chart of common fossils at Grand Canyon on the back page.

## Think About It

THE OLDEST PANCAKE IN A STACK IS ALWAYS AT THE BOTTOM. THE ROCKS AT GRAND CANYON ARE A LOT LIKE PANCAKES. WHERE DO YOU FIND THE OLDEST ROCKS AT GRAND CANYON?



## Vocabulary:

**Fossils:** the hardened remains or imprints of plants or animals preserved in rock

**Geology:** the study of the origin, history and structure of the earth

## Cool Canyon Facts

River length: 277 miles

Canyon width: 10 miles

Canyon depth: 1 mile

Rocks come in all colors, shapes, and sizes. They can be very different, but to make sense of what is around us, **geologists** put rocks in groups according to how they form. The three families of rock are: **igneous**, **sedimentary** and **metamorphic**. Natural forces create and destroy rock, changing them over time in the rock cycle.

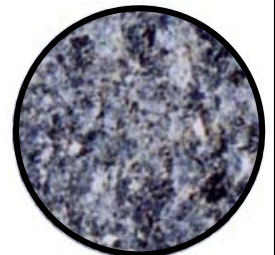


**Igneous rocks** are formed when rock is super-heated and becomes molten (liquid). There are two kinds of molten rock: magma (found beneath the Earth's surface) and lava (found on the Earth's surface). The molten rock cools and hardens on or beneath the Earth's surface forming a variety of igneous rock. Two examples are granite and basalt.

**Sedimentary rocks** are made of smaller pieces (like sand or mud), called sediments, that pile into layers. As pressure on the sediment increases over time, minerals act like glue, cementing them into solid rock. The three main types of sedimentary rocks at Grand Canyon are sandstone, shale (or mudstone), and limestone.

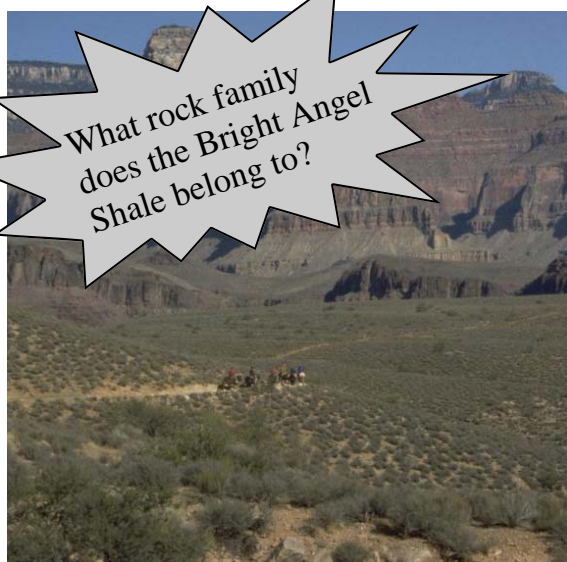
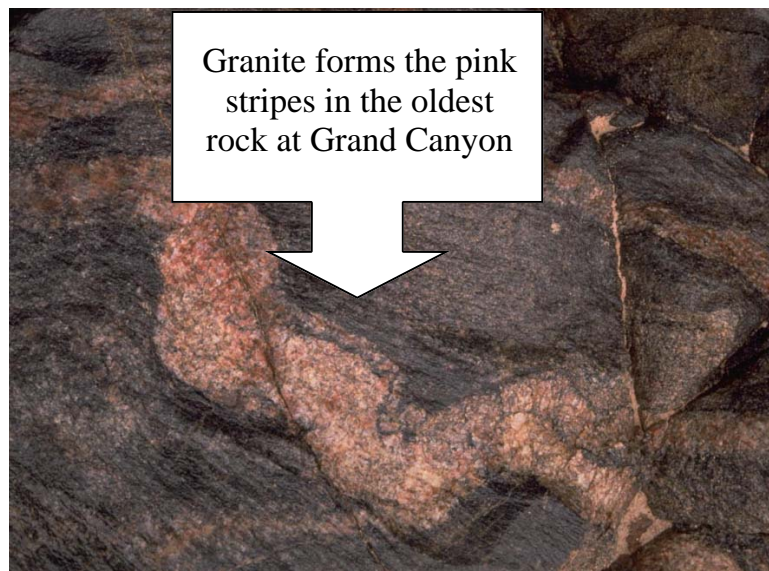


**Metamorphic rocks** are rocks that have been changed under great heat and pressure. The original rock can be sedimentary, igneous, or even metamorphic. The original rock is changed into something new, just as a caterpillar "metamorphoses" into a butterfly.



## Precambrian Basement Rocks

The basement rock formed 1.8 billion years ago when the North American continent collided with an ancient chain of volcanic islands, much like today's Hawaiian Islands. Intense heat and pressure from the collision formed the metamorphic rock called Vishnu Schist. From deep under the earth's surface, molten rock flowed up as magma between the cracks of the Vishnu Schist. As the flowing magma cooled and hardened, it formed igneous rock called Zoroaster Granite. Because of the extreme heat and pressure that folded and changed the metamorphic rock, it is hard to find any fossils in the basement rocks.



## Bright Angel Shale

If you came to Grand Canyon area 515 million years ago when the Bright Angel Shale was forming, everything was covered by a very muddy, warm, shallow sea. Trilobites, brachiopods, crinoids and worm-like creatures that burrowed in the sea-floor thrived in the nutrient-rich water. This greenish-colored shale forms the broad, flat area known as the Tonto Platform in Grand Canyon.

## Redwall Limestone

About 340 million years ago, North America lay close to the equator when the Redwall Limestone formed. Grand Canyon was covered by a shallow, warm, clear and well-lit sea where many crinoids lived. Fossils in the rock tell us that corals, cephalopods, bryozoans, and brachiopods lived here. While the limestone itself is gray in color, the surfaces of the exposed cliffs are stained red by iron in rock eroding from the layers above with rain and snow melt.

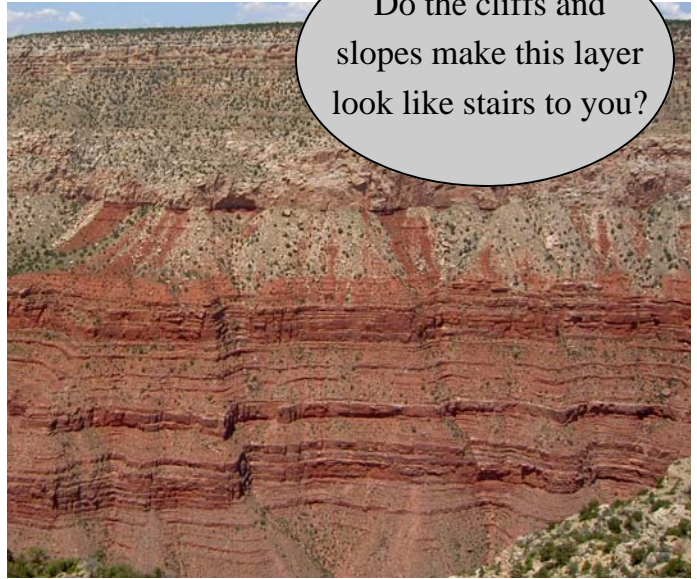


This limestone layer is 500 feet thick and creates the tallest cliff in Grand Canyon.

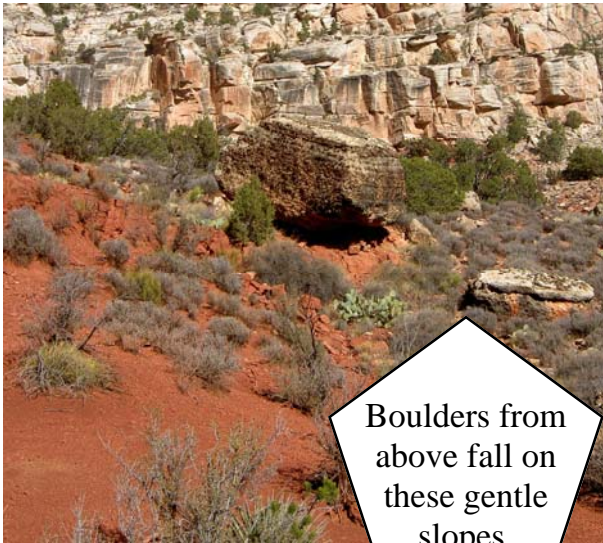


### Supai Group

How do you feel about a trip to the beach? About 300 million years ago, the Grand Canyon area was covered by rapidly changing coastlines as sea levels rose and fell. The Supai group has limestone, sandstone, and shale in it, sharing the story of beaches, dunes, and sometimes oceans that were found here. The ocean environments left behind fossils of brachiopods, while the land environments left various plant fossils for geologists to find. Both environments contained multiple types of burrowing creatures.



Do the cliffs and slopes make this layer look like stairs to you?



Boulders from above fall on these gentle slopes.



### Hermit Shale

Are you ready to go wading through the mud? 280 million years ago The Grand Canyon area was covered by a broad coastal plain fed by multiple slowly meandering streams. The environment was prime habitat for an abundance of ferns and conifers, along with reptiles and insects, including dragonflies with three-foot wingspans. This layer consists of siltstones, mudstones, and fine grained sandstones rich in iron that create a gentle, red slope in most parts of Grand Canyon National Park.



### Coconino Sandstone

Have you ever wanted to visit the Sahara desert? 275 million years ago the Grand Canyon area was covered with coastal dune-fields that reached as far north as present day Monument Valley, and as far south as Sedona. The ocean lay to the west. Reptiles, spiders, scorpions, and other insects dwelled on the sand dunes of this extensive desert, leaving their tracks fossilized in the sandstone. This sandstone layer creates a broad, light-colored



This striking white cliff earns the name "bathtub ring" of Grand Canyon.

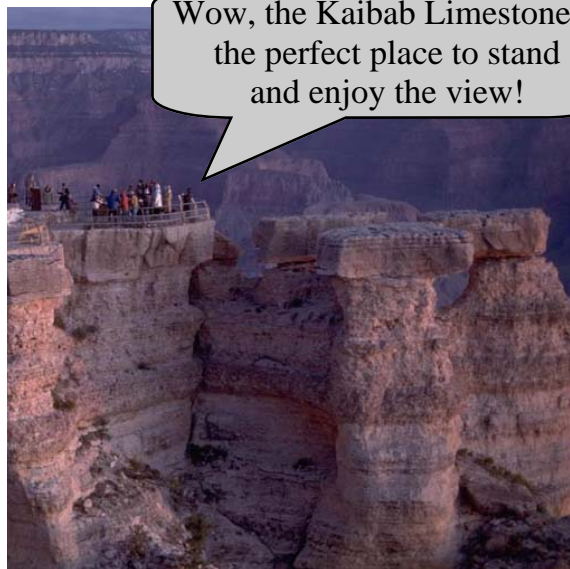
cliff a few hundred feet below the rim of Grand Canyon. Cross-bedding (lines that run at steep angles to one-another) can be seen in the rock, giving evidence to the sand dunes that once covered the area.



## Kaibab Limestone

270 million years ago North America was the western part of the super-continent Pangaea. The Grand Canyon region was once again covered by a shallow, warm, and well-lit clear sea with a sandy/muddy floor. The coast was nearby and to the northeast. Brachiopods and sponges dominated these waters. Other species included crinoids, corals, bryozoans, cephalopods, sharks and fish.

This limestone is the youngest rock found at Grand Canyon National Park.



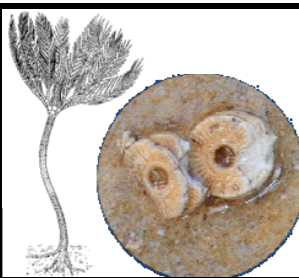
Wow, the Kaibab Limestone is the perfect place to stand and enjoy the view!

Are any of these fossils found in your backyard?

**Fossils of Grand Canyon** Here are some of the more common fossils found in the sedimentary layers of Grand Canyon...

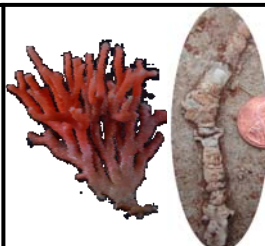


**Brachiopods**– A variety of shells lived in clear ocean waters.



**Crinoids**– Tiny disks made the stem and arms of this animal, that was rooted to the sea floor.

**Bryozoans**– These are apartment complexes for microscopic (that's really small!) animals.



**Ferns**– These fossils are the imprints of where leaves fell into the mud thousands of years ago.

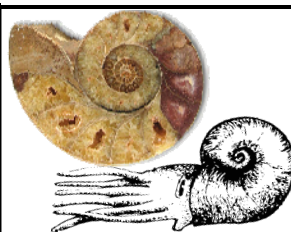


**Burrows of animals**– Worms and trilobites dug tunnels in the soft muddy sediment under the sea floor.



**Sponges**– Sea sponges are one of the most common fossils in the youngest layer at Grand Canyon.

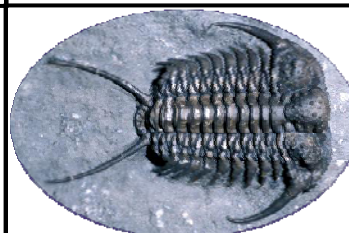
**Cephalopods**– These creatures roamed the sea and are related to the squid in today's oceans.



**Tracks**– Reptiles and other animals left their mark in the mud and sand where they lived.



**Coral**– This predator was rooted to the sea floor. Descendants of this animal still live in today's oceans.



**Trilobites**– These segmented animals could be the size of your thumb or a dinner plate!

### Assignment #3

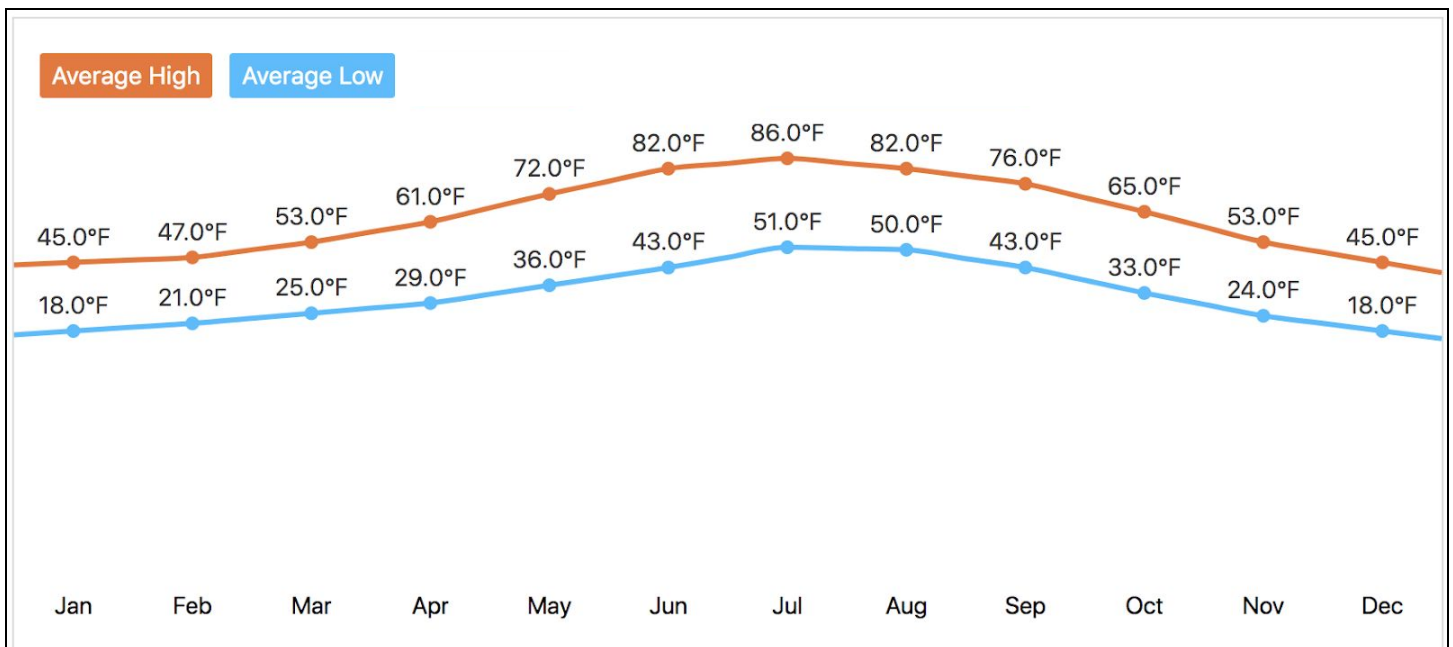
What type of weathering contributed to the formation of the Grand Canyon?

#### Part 1

#### Grand Canyon Climate

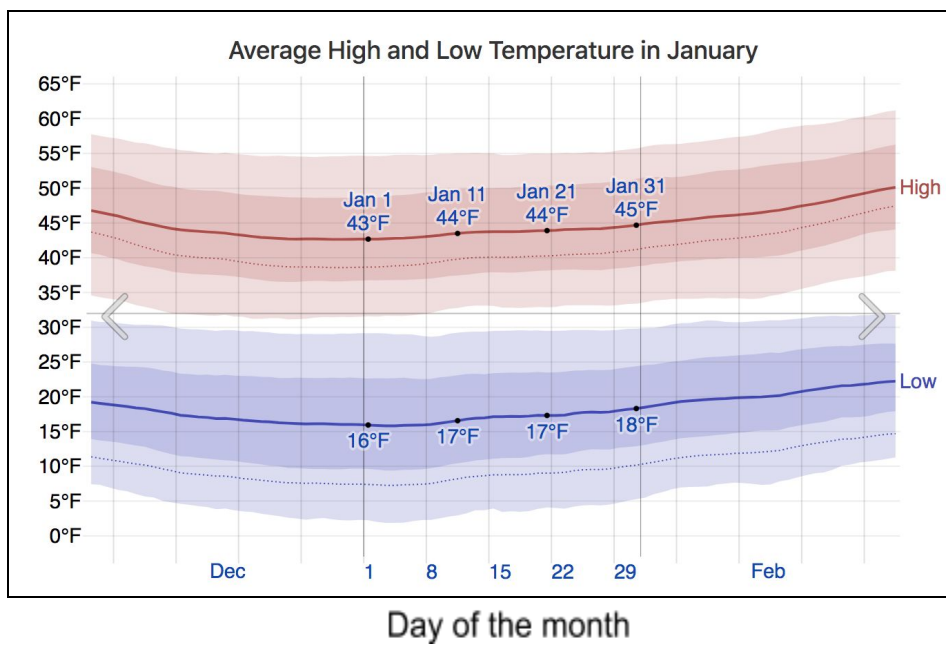
1. Examine the graph below. During which month is there the biggest difference between the average low temperature and the average high temperature? How much is the difference?

**Grand Canyon Average Monthly High and Low Temperatures**



2. One of the coldest months in the Grand Canyon is January. Examine the graph of January temperatures in the Grand Canyon below.

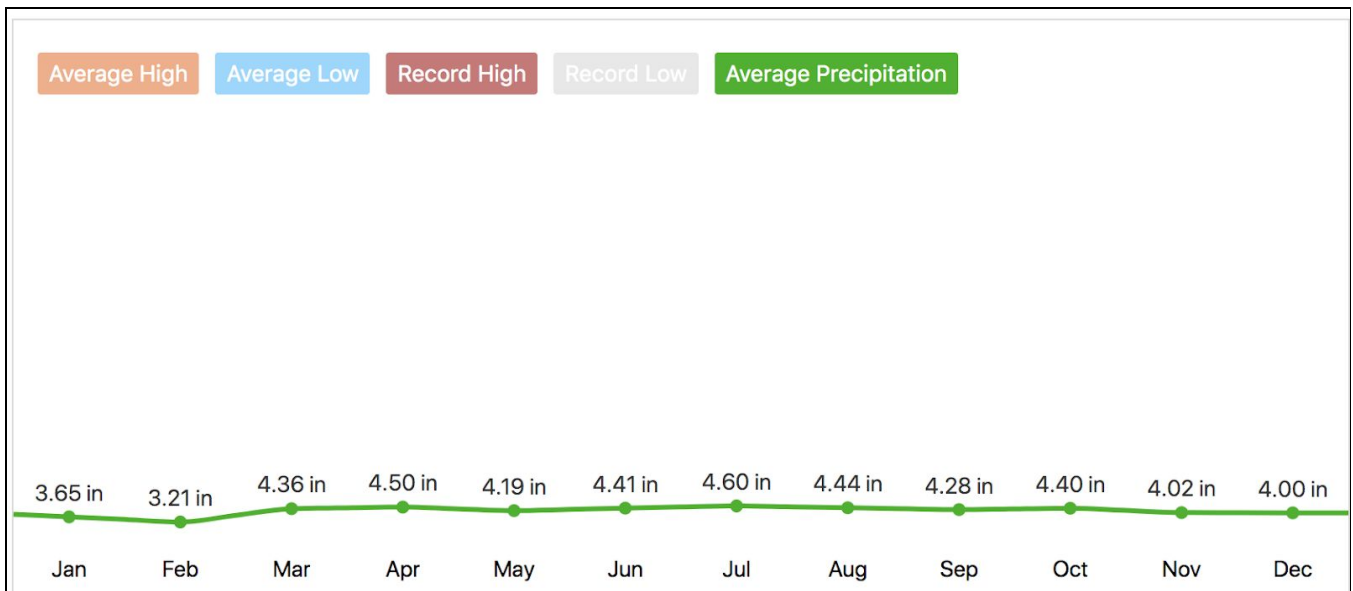
Does the Grand Canyon ever experience temperature below and above freezing (32 degrees F) on the same day? Be sure to cite evidence from the graph.



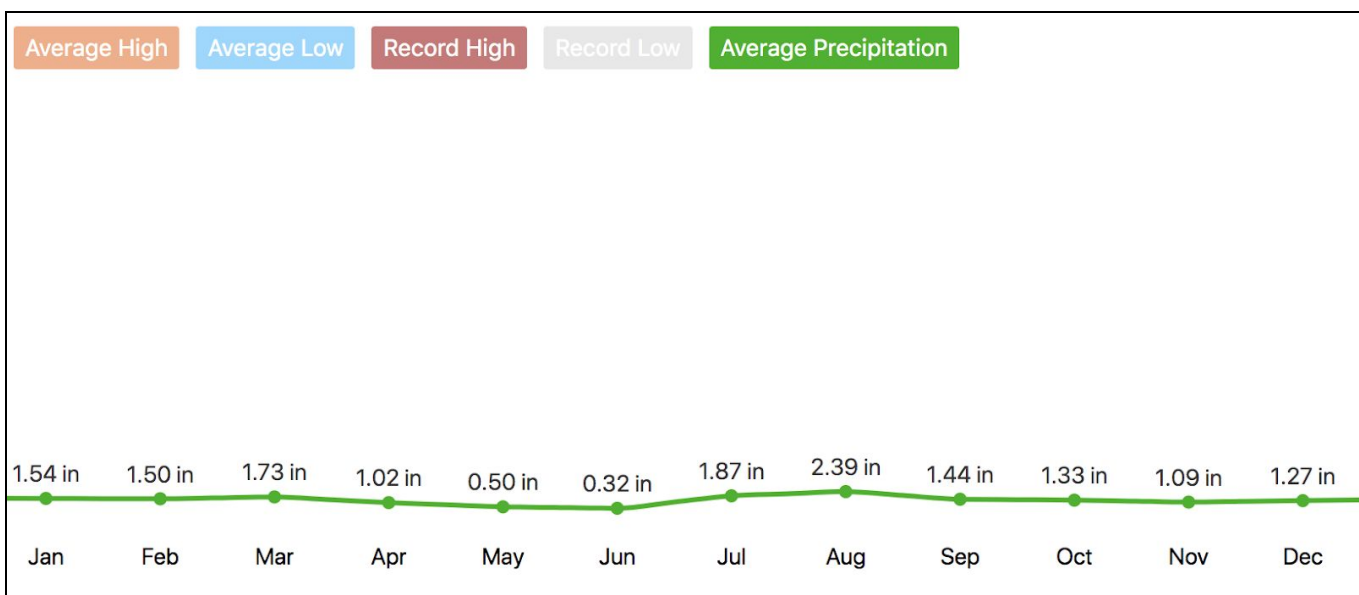
3. Examine the graphs below. Does it rain or snow (precipitation) at the Grand Canyon? How does the precipitation in the Grand Canyon compare to the precipitation in New York City?



### Grand Canyon Average Monthly Precipitation



### New York City Average Monthly Precipitation



Summarize your observations, thoughts, and questions from **Part 1: Grand Canyon Climate**, in the space provided below.

<b>See</b> What are some of your observations?	<b>Think</b> What does each observation make you think about the Grand Canyon formation?	<b>Wonder</b> What questions do you have about each observation?

**Part 2**

- Read the text, *Weathering*.
    - As you read, use a yellow highlighter (or underline) to highlight ideas that you think connect to what you learned about the Grand Canyon's climate and might offer clues about the type of weathering that may have broken apart rock to form the Grand Canyon. Use green to highlight (or circle) ideas you don't understand or have questions about.
- 1) What ideas from the text do you think connect to what you learned about the Grand Canyon's climate? Be sure to explain why you think they connect.

- 2) What questions do you have about the text?

- Now that you have read about the types of physical and chemical weathering, make an evidence-based claim below about at least one type of physical weathering and one type of chemical weathering you think could have broken apart rock to form the Grand Canyon.

### Physical Weathering Claim

Claim	Evidence Consider rock and mineral composition and climate at the Grand Canyon.	Reasoning How does the evidence connect to the description of the physical weathering you claimed?
The type of physical weathering I think may have broken apart rock to form the Grand Canyon is...		

### Chemical Weathering Claim

Claim	Evidence Consider rock and mineral composition and climate at the Grand Canyon.	Reasoning How does the evidence connect to the description of the chemical weathering you claimed?
The type of chemical weathering I think may have broken apart rock to form the Grand Canyon is...		



# Weathering

Rocks gradually wear away. This is called weathering. Two types of weathering are:

- physical weathering
- chemical weathering

## Physical weathering

Physical weathering is caused by physical changes such as: changes in temperature, freezing and thawing, and the effects of wind, rain and waves. Here is a description of each of the three types of physical weathering:

- **Temperature changes**  
When a rock gets hot it expands a little, and when a rock gets cold it contracts a little. If a rock is heated and cooled many times, cracks form and pieces of rock fall away. This type of physical weathering happens a lot in deserts, because it is very hot during the day but very cold at night.
- **Wind, rain and waves**  
Wind, rain and waves can all cause weathering. The wind can blow tiny grains of sand against a rock. These wear the rock away and weather it. Rain and waves can also wear away rock over long periods of time.
- **Freeze-thaw**  
Water expands slightly when it freezes into ice. This is why water pipes sometimes burst in the winter. You might have seen a demonstration of this sort of thing at school - a jar filled to the brim with water eventually shatters after it is put into a freezer.

The formation of ice can also break rocks. If water gets into a crack in a rock and then freezes, it expands and pushes the crack further apart. When the ice melts later, water can get further into the crack. When the rock freezes again, it expands and makes the crack even bigger.

This process of freezing and thawing can continue until the crack becomes so big that a piece of rock falls off.

## Chemical weathering

The weathering of rocks by chemicals is called chemical weathering. Some types include:

- **Rainwater**  
Rainwater is naturally slightly acidic because **carbon dioxide** from the air dissolves in it. Minerals in rocks may react with the rainwater, causing the rock to be weathered.
  - Some types of rock are easily weathered by chemicals. For example, **limestone** and **chalk** are made of a mineral called calcium carbonate. When acidic rainwater falls on limestone or chalk, a chemical reaction happens. New soluble substances are formed in the reaction. These are washed away and the rock is weathered.



Chemical weathering can hollow out caves and make cliffs fall away.

- Some types of rock are **not** easily weathered by chemicals. For example, **granite** and **gabbro** are hard rocks that are weathered only slowly. Still some of their minerals do react with the acids in rainwater to form new, weaker substances that crumble and fall away.

- **Acid Rain**

When fossil fuels such as coal, oil and natural gas are burned, **carbon dioxide** and **sulphur dioxide** escape into the air. These dissolve in the water in the clouds and make the rainwater more acidic than normal. When this happens, we call the rain '**acid rain**'.

Acid rain makes chemical weathering happen more quickly. Buildings and statues made from rock are damaged as a result. This is worse when the rock is limestone rather than granite.



**Statues damaged by acid rain**