Earth Science: How Humans Are Impacting Water
Middle School, 6th Grade
Spring 2013

Project READI Curriculum Module

Technical Report CM #26

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PROJECT READi

inquirium

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WestEd

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Please send us comments, questions, etc.: info.projectreadi@gmail.com

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Project READI operated as a multi-institution collaboration among the Learning Sciences Research Institute, University of Illinois at Chicago; Northern Illinois University; Northwestern University; WestEd's Strategic Literacy Initiative; and Inquirium, LLC. Project READI developed and researched interventions in collaboration with classroom teachers. These interventions were designed to improve adolescents' reading comprehension through argumentation from multiple sources in literature, history, and the sciences. Curriculum materials such as those in this module were developed based on enacted instruction and are intended as case examples of the READI approach to deep and meaningful disciplinary literacy and learning.

How do humans impact water?

Interactive Notebook

Name: _____
Teacher_____
Date_____

Inquiry questions:

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

As we answer these questions, we will also better understand…

4. How do people ***read*** science?

5. How are models ***created***, ***revised***, and ***used*** in

THINKING ABOUT SCIENCE READING

INTRODUCTION. MAKE CHECKMARKS NEXT TO STRATEGIES YOU HEAR YOUR TEACHER USE.

THINK ALOUD CHECKLIST

Setting Purposes

- ❑ I'm interested in …
- ❑ I want to figure out …

Questioning

- ❑ I wonder why/ how/ if…
- ❑ Could this mean …

Predicting

- ❑ I think the next part will …

Picturing

- ❑ I can picture/ imagine/ see …

Making Connections

- ❑ I already knew …
- ❑ This reminds me of…

Identifying Roadblocks

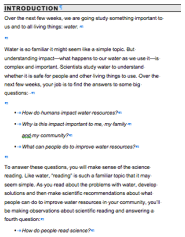
- ❑ I'm confused about …
- ❑ I need to know more about …

Summarizing

- ❑ This is about …
- ❑ The big idea here is …

Using Fix-Ups

- ❑ I'll re-read this
- ❑ I'll mark this and come back



INTRODUCTION

Over the next few weeks, we are going study something important to us and to all living things: water.

Water is so familiar it might seem like a simple topic. But understanding impact—what happens to our water as we use it—is complex and important. Scientists study water to understand whether it is safe for people and other living things to use. Over the next few weeks, your job is to find the answers to some big questions:

- *How do humans impact water resources?*
- *Why is this impact important to me, my family and my community?*
- *What can people do to improve water resources?*

To answer these questions, you will make sense of the science reading. Like water, "reading" is such a familiar topic that it may seem simple. As you read about the problems with water, develop solutions and then make scientific recommendations about what people can do to improve water resources in your community, you'll be making observations about scientific reading and answering a fourth question:

- *How do people read science?*

INTRODUCTION TO WATER UNIT *READER R2*

INTRODUCTION

Make checkmarks next to strategies you hear your teacher use while thinking aloud about the "Introduction"

OUR READING STRATEGIES	HOW THEY HELPED US READ

INTRODUCTION

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- Why is this impact important to me, my family and my community?
- What can people do to improve water resources?

To answer these questions, you will make sense of the science reading. Like water, "reading" is such a familiar topic that it may seem simple. As you read about the problems with water, develop solutions and then make scientific recommendations about what people can do to improve water resources in your community, you'll be making observations about scientific reading and answering a lot of questions.

- How do people read science?

THINK WRITE, PAIR SHARE *READER R2*

You might already know a whole lot about our essential questions: water and how humans impact this important resource. Use the space below to first record your initial answers to the first 3 essential questions. Then, share these ideas with your partners, and then, your class.

<u>THINK WRITE</u> - My initial ideas about the essential questions:

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

PAIR SHARE - Norms for pair share:

Speaking Pair share your ideas about the essential questions above

- One thing you are confident about, as you think about how humans impact water
- Something that you are unsure about, or something you have questions about

Listening Pair respond to your pairs' ideas

- What you understand really well about how humans impact water
- What is unclear to you about how humans impact water
- Before switching, make notes about new ideas you have for how humans impact water

Remember to use draw on the information from the text to support your critique or praise of one another's work!

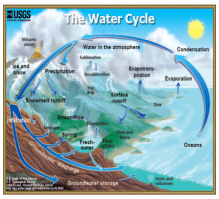
WHOLE CLASS SHARE - Share you and your partner's ideas with the class.

WHAT'S IN OUR WATER?

Scientists "read" when they observe and collect data about the world. When they write about their observations, questions and thinking, the writing becomes a science text.

- Observe how you and others use water over the next 24 hours. Write notes about your observations in the evidence column, below.

EVIDENCE I saw…	**INTERPRETATION** I thought…	**NEXT STEPS** I wondered…
What do people <u>use water for?</u>	**What is <u>in</u> the water people use?**	**How <u>safe</u> is the water people use?**

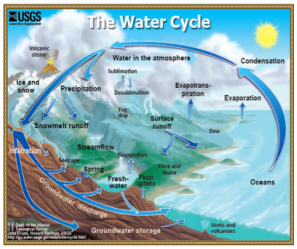


WHAT HAPPENS TO WATER IF WE DON'T' USE IT?

READER R3

Add notes to the Reading Strategies List after using your reading strategies to read "what happens to water if we don't' use it?" <u>Try to use what you learned in the mini-models unit to help you make sense of this text!</u>

OUR READING STRATEGIES	HOW THEY HELPED US READ



WHAT HAPPENS TO WATER IF WE DON'T' USE IT?

READER R3

Scientists draw on texts – both written text and visual models, to help them build new understandings about the world around them. One important way to do this is to identify evidence in the text that helps them answer their inquiry questions. Below, identify the evidence that helps you better answer the essential questions. Then, make interpretations from evidence, and ask yourself what else you need to understand to help you address the essential questions.

EVIDENCE What we saw in the text	**INTERPRETATION** What we thought about it	**NEXT STEPS** What we think we know or need to know now

What important key ideas did you gather from this model?

What additional questions do you have about this model?

THINK WRITE, PAIR SHARE ABOUT MODELS

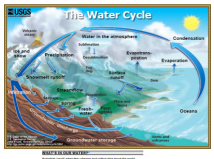
COLLABORATIVE PEER REVIEW—PAIR TO PAIR

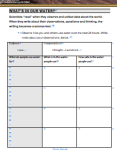
Scientists often build and revise models to help them keep track of their ideas. In this unit, we will do the same! As you encounter more and more texts, we will be using modeling to help us better understand the movement of water and how humans impact the water. First, take some time to think about what components this model should have. Then, share these ideas with your partner and then the class.

THINK WRITE - My initial ideas about what needs to be included in the model:

PAIR SHARE – What components does your partner think needs to be included?

WHOLE CLASS SHARE - Share you and your partner's ideas with the class.





SCIENTIFIC MODELING *READER R2, R3*

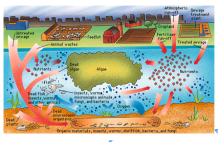
As you learned in the mini modeling unit, scientists use models to help them better understand the science that is going in the world around them. In this unit, we will not only read models, but also build them as we read more and more texts about how humans are impacting water. Below, record the class consensus model that represents our ideas so far.

What makes a good scientific model?

Our consensus model

What questions does your class still have about the model?

What else do we need to know to answer our essential questions?



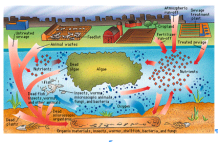
HOW ARE HUMANS IMPACTING WATER? *READER R4*

Use the reading strategies we have learned so far to read this text "how are humans impacting water?" As you read, make annotations on the text, looking for evidence of how humans impact the flow of water you saw in the previous text "the water cycle". Do some thinking on your own, and then pair up and share your ideas.

THINK WRITE – Find evidence from this text that helps you think about *how are humans impacting water.* How is the same or different than your previous ideas?

PAIR SHARE – What evidence did your partner find in the text? Are they similar or different than the ones you found?

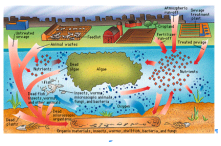
WHOLE CLASS SHARE - Share the evidence you and your partner found in this text with the class.



HOW READING STRATEGIES HELP US

We have been using reading strategies to help us identify evidence in each of the texts we encounter. These pieces of evidence can help us better understand how humans impact water. Record any new strategies that you, your partner, or your teacher uses that helps you make sense of the text.

NEW READING STRATEGIES	HOW THEY HELPED US READ



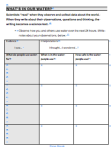
HOW ARE HUMANS IMPACTING WATER?

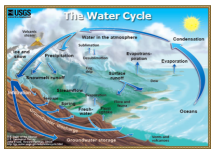
EVIDENCE AND INTERPRETATION NOTES

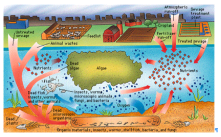
Make notes during the class discussion

EVIDENCE	INTERPRETATION	NEXT STEPS
What we saw in the text that helps us answer the essential questions	What the evidence suggests should include in our consensus model	What we think we know or need to know now, given the available evidence

SCIENTIFIC MODELING *READER R2, R3, R4*







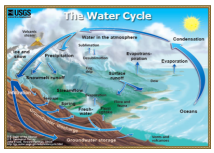
Based on the evidence from the texts we just read, your pair and class discussions, draw the class consensus model below of how humans impact water.

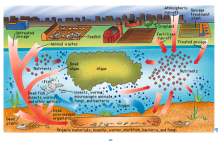
Remember, models should…

- _____
- _____
- _____

Class consensus model

ESSENTIAL QUESTIONS *READER R2, R3, R4*





ANSWER THE QUESTIONS THAT YOU CAN NOW, BASED ON THE READING SO FAR.

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

4. How do people read science?

5. How are models ***created***, ***revised***, and ***used*** in science?

WHAT'S IN THIRD CREEK? WHAT'S IN THE CHICAGO RIVER?

READER R5, R6

READING STRATEGIES LIST

We have been using reading strategies to help us identify evidence of how humans impact water as we encountered written text, scientific models, and now, pictures. Write down any new reading strategies that we can use to help us identify important pieces of evidence in these texts.

NEW READING STRATEGIES	HOW THEY HELPED US READ

WHAT'S IN THIRD CREEK? WHAT'S IN THE CHICAGO RIVER?

READER R5, R6

EVIDENCE AND INTERPRETATION NOTES

EVIDENCE What we saw in the text that helps us answer the essential questions	**INTERPRETATION** What the evidence implies about how humans impact water	**NEXT STEPS** What we think we know or need to know now, given the available evidence

EVIDENCE AND INTERPRETATION NOTES *READER R7-8*

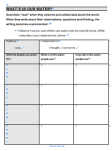
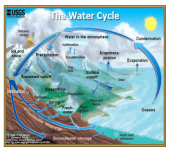
WHAT'S IN YOUR LEMONADE?

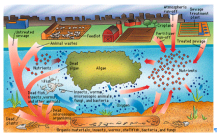
Make notes during the class discussion

http://water.epa.gov/aboutow/owow/videocontest.cfm#winners

EVIDENCE	INTERPRETATION	NEXT STEPS
What we saw in the video that helps us answer the essential questions	What the evidence implies about how humans impact water	What we think we know or need to know now, given the available evidence

SCIENTIFIC MODELING *READER R2-8*




In class, we have been using our reading strategies with multiple types of text, looking for evidence that helps us better understand how humans impact water. When scientists encounter new pieces of evidence, often times they need to go back and update their models, using this new information. Drawing on your knowledge of our previous consensus model (p. 16 of this packet), and all of our additional pieces of evidence, <u>think about what new components need to be added to the model</u>. Then, as a class, construct your consensus model.

<u>THINK WRITE</u> – What new <u>evidence</u> do we have that helps us better understand *how are humans impacting water?* What new components do we need to add to our model?

Models should help us….

New evidence from the readings tells me that….

We should revisit our model and update it by…

Class consensus model

What questions does your class still have about the model?

What else do we need to figure out to answer the essential question?

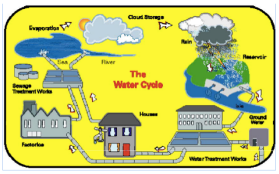
EVIDENCE AND INTERPRETATION NOTES

READER R9

WHAT'S IN THE WATER AT THE BEACH?

First, discuss with your partner what kind of evidence you are looking and the kinds of interpretations you would like to make about that evidence. Then, read the text by yourself, using the reading strategy checklist.

EVIDENCE	INTERPRETATION	NEXT STEPS



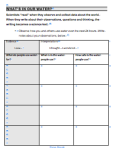
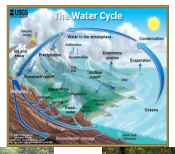
WHERE DOES WATER COME FROM? WHERE DOES IT GO?
READER R10-11

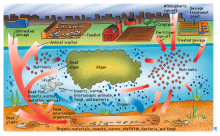
MAKING COMPARISONS OF SCIENTIFIC MODELS

In the 'Reading science models' unit, we began to look at different scientific models and brainstorming what makes a good scientific model. Often times, evaluating models is not a simple task because models can be created to convey different kinds of information. First, read the text "where does water come from? Where does it go?" Then, compare the model in this text and describe how it is *similar* or *different* than the one that we have built. Finally, think about what new information we can get from this text to update our model to help us answer the essential questions

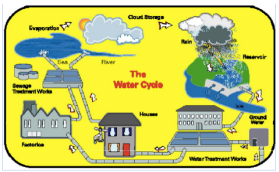
HOW IS THIS MODEL SIMILAR TO OUR CONSENSUS MODEL?	HOW IS THIS MODEL DIFFERENT THAN OUR CONSENSUS MODEL SO FAR?

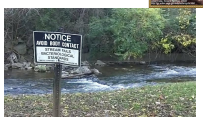
ESSENTIAL QUESTIONS *READER R2-11*

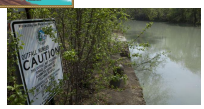













ANSWER THE QUESTIONS THAT YOU CAN NOW, BASED ON THE READING SO FAR.

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

4. How do people read science?

5. How are models ***created***, ***revised***, and ***used*** in science?

WHERE DOES THE RUNOFF GO? *READER R12*

We have been talking about how humans impact water, and getting more and more evidence from each text we read. With final text, use your reading strategies checklist to find new pieces of evidence that helps us answer the essential questions. Then, share with your partner and the class

THINK WRITE – Find evidence from this text that helps you think about *how are humans impacting water.* How is the same or different than your previous ideas?

PAIR SHARE – What evidence did your partner find in the text? Are they similar or different than the ones you found?

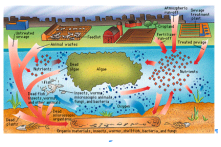
WHOLE CLASS SHARE - Share the evidence you and your partner found in this text with the class.

WHERE DOES THE RUNOFF GO? *READER R12*

EVIDENCE AND INTERPRETATION

Using your think write, pair share and whole class discussions, first determine what kind of evidence you are looking for in this text, Then, identify the evidence and how that evidence helps you answer the essential question. Finally, write out the additional questions you have after reading this text.

EVIDENCE	INTERPRETATION	NEXT STEPS



HOW ARE HUMANS IMPACTING WATER? *READER R4*

Often times, scientists have to read texts multiple times to *really* understand them. We have read so many texts about how humans impact water, it's time to go back to one of the important texts from the beginning of this unit, "how are humans impacting water?" Take this time to notice things you did not notice the first time around, and answer the following questions:

1. What new pieces of evidence do you notice now, that you did not notice before?

2. How does this new information help us answer the essential questions?

3. How did you read this text *differently*, now that we have gained new understandings about how humans impact water?

WHAT'S THE STATE OF OUR WATER *READER R13*

Carefully read and annotate this text. Then, share with your partners about what new pieces of evidence. Think about how this new information helps you answer the essential questions.

What new information did you find?

What essential questions does this help you answer?

ESSENTIAL QUESTIONS *READER R2-12*

ANSWER THE QUESTIONS THAT YOU CAN NOW, BASED ON THE READING SO FAR.

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

Lastly, think about what you have learned about how scientists read and use models in their work:

4. How do people read science?

5. How are models ***created***, ***revised***, and ***used*** in science?

SCIENTIFIC MODELING *READER R2-12*

Generate the class consensus models for water based on the readings so far.

Remember, models should…

- _____
- _____
- _____

Class consensus model

CONSEQUENTIAL TASK

Recommendation task: What can we do about this problem of impact?

Since the beginning of this unit, we've been thinking about how humans impact the water cycle. Now it's your turn to take this information and generate a solution to the human impact that we have on the water cycle.

Based on the texts (and the evidence within them) and also the model that we have generated based on these texts, make a recommendation of what can be done to address this problem of human impact. Use the following guidelines as you generate your solution.

A. As you create your solution, you should include….

1. **Problem statement** (text based)
    a. How do humans impact the water cycle?
    b. What evidence do you have that this is a problem (remember to draw on the evidence, interpretations and models you have been gathering so far in this module)
2. **Solution statement**
    a. What is your solution?
    b. What supports your solution? (you should be able to point to evidence, interpretations or the model you have been generating in this module to support your solution)

B. Make use of all that we've been learning!

We've been building a model all along this unit – how could this model help us in making our recommendation?

Recommendation task: What can we do about this problem of impact?

Write your solution in the space below…

- The problem is….
- My solution is….
- I think this will help address how humans impact water because…. (draw on evidence that we have been collecting throughout this unit!)
- My solution is based on…

Student Reader

"How do humans impact water?"

Name: _____

Teacher_____

Date_____

INTRODUCTION

Over the next few weeks, we are going study something important to us and to all living things: *water.*

Water is so familiar it might seem like a simple topic. But understanding impact—what happens to our water as we use it—is complex and important. Scientists study water to understand whether it is safe for people and other living things to use. Over the next few weeks, your job is to find the answers to some big questions:

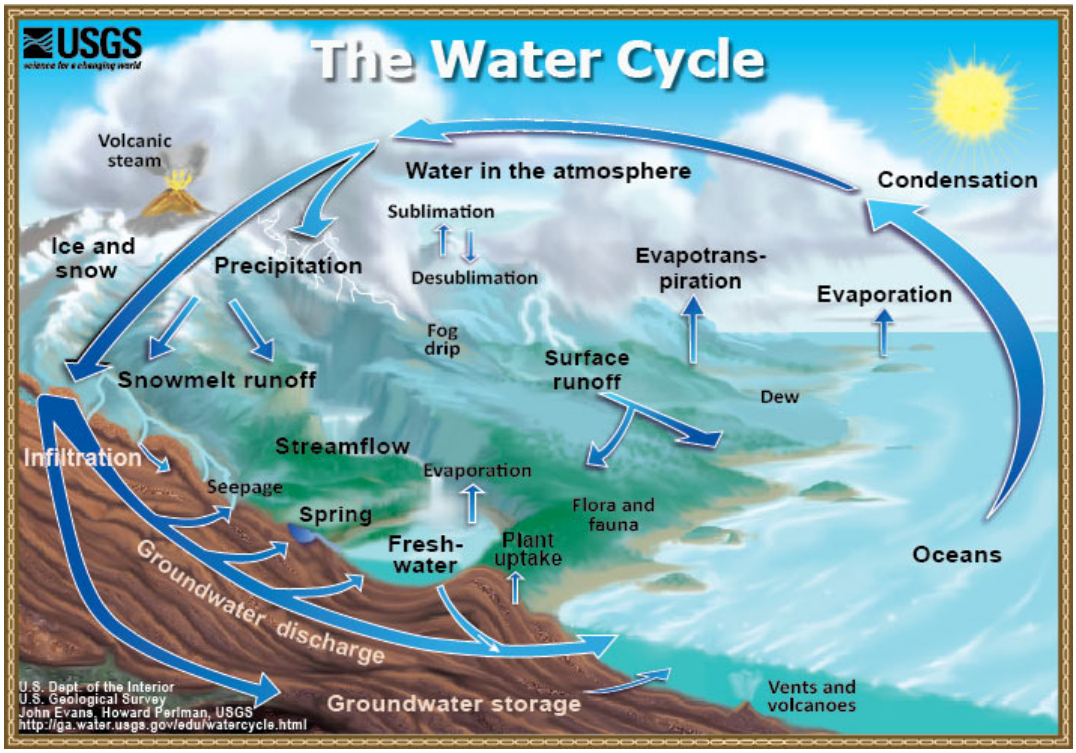
- *How do humans impact water resources?*
- *Why is this impact important to me, my family and my community?*
- *What can people do to improve water resources?*

To answer these questions, you will make sense of the science reading and build a scientific model. Like water, "reading" is such a familiar topic that it may seem simple. As you read about the problems with water, develop solutions and then make scientific recommendations about what people can do to improve water resources in your community, you'll be making observations about scientific reading to better understand…

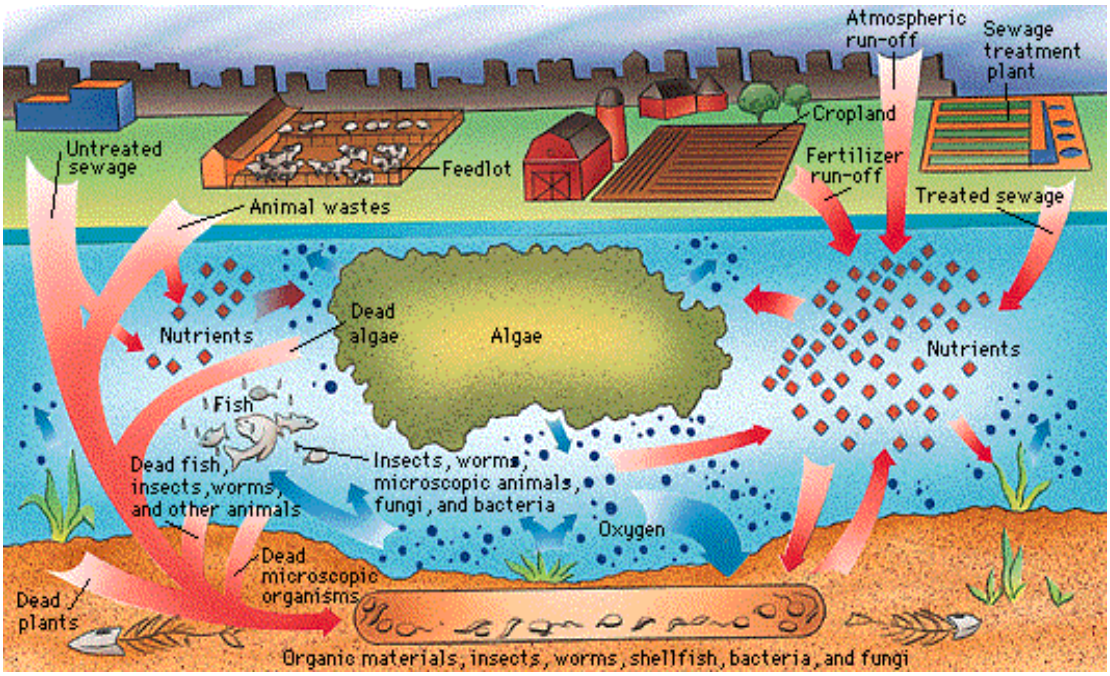
- How do people read science?
- How are models *created*, *revised*, and *used* in science?

WHAT HAPPENS TO WATER IF WE DON'T USE IT?

READ THIS TEXT AND WRITE NOTES ON THE PAGE ABOUT YOUR QUESTIONS, CONNECTIONS AND THOUGHTS.



HOW ARE HUMANS IMPACTING WATER?



WHAT'S IN THIRD CREEK?

READ AND ANNOTATE

As you read the photo and the caption below, make notes on this page about your questions, connections and thoughts.

Third Creek Unsafe for Swimming

Scientists tested water in Third Creek and found bacteria that can cause disease in humans.

Adapted from the Tennessee Journalist, January 12 2011.

WHAT'S IN THE CHICAGO RIVER?

READ AND ANNOTATE

- Use ideas from the class discussion about how we read science and your think aloud bookmarks as you read and make notes about your thinking.

Chicago River Contaminated

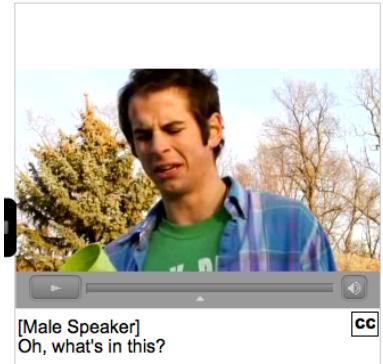
A sign by the North Shore Canal warns people about the water. Chicago's water system combines sewage and rain water in the same pipes. During heavy storms sewage and bacteria flow into the Chicago River from outfall pipes like the one in this photo.

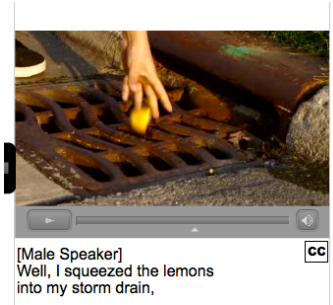
Adapted from the Chicago News Cooperative, May 17, 2011

WHAT'S IN YOUR LEMONADE?

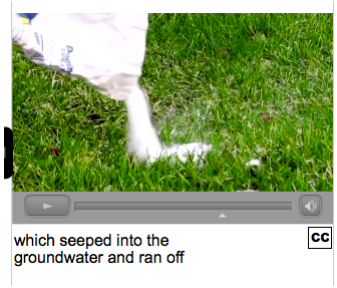
READ THE VIDEO AND ANNOTATE

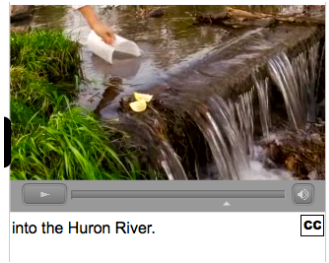
- Videos can be a kind of science text we can read and think about. As you watch the video, use your Think Aloud Bookmarks.
- Sketch and make notes about what you see in the video.
- Ask your teacher to replay parts for you to re-read, if needed.

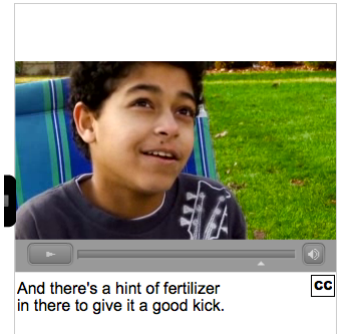




And I sprinkled the sugar onto my lawn







WHAT'S IN THE WATER AT THE BEACH?

READ AND ANNOTATE

Use ideas from the class discussion about how we read science and your think aloud bookmarks as you read and make notes about your thinking.

No Day at the Beach

Our planet's lakes and oceans have been making headlines all year, especially as summer revelers flock to the beach in droves.

Put bluntly, the problem is poop. Fecal pollution--mainly from raw sewage--is contaminating large stretches of recreational water from the Gulf Coast to the Great Lakes.

Swimming in unsafe water can lead to sore throats and diarrhea, as well as more serious illnesses like meningitis and severe gastroenteritis. Recent research has shown that, after many years of decline, death rates from microbial gastrointestinal illness are on the rise.

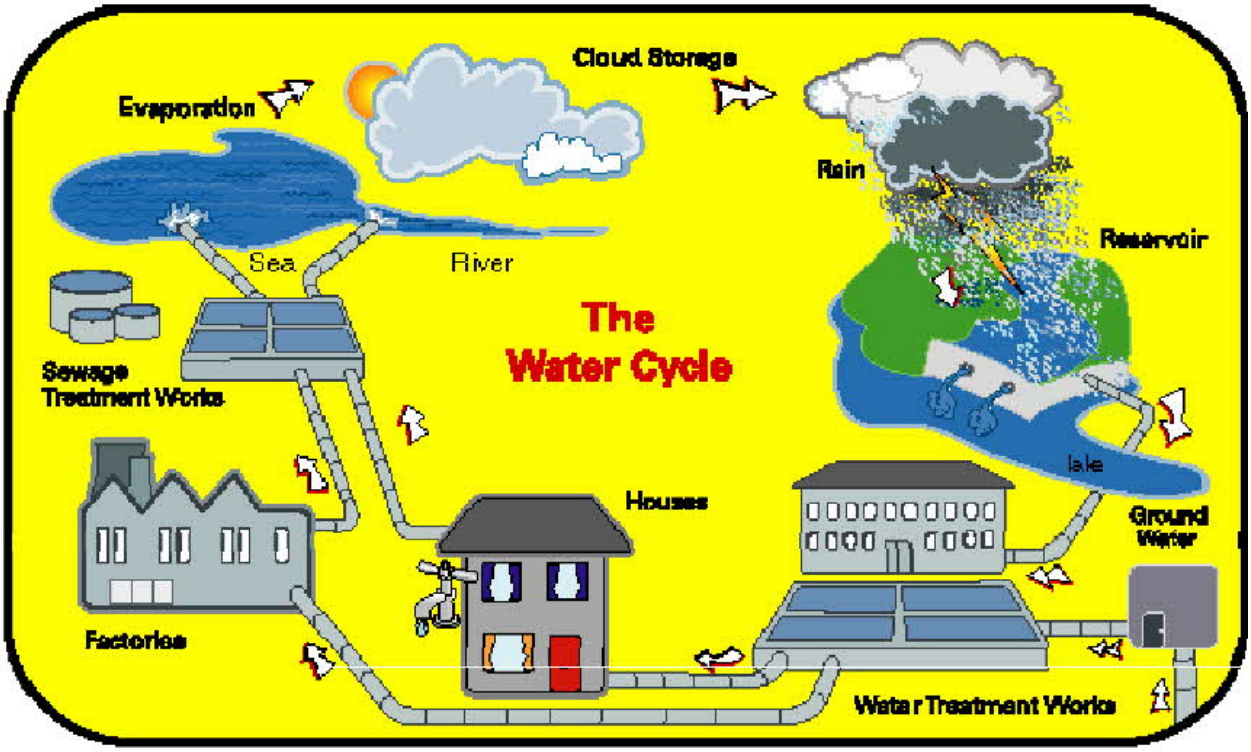
Pollution caused more than 12,000 beach closings and advisories in 2002--the second highest in the last thirteen years, according to a study by the Natural Resources Defense Council.

Source: *Adapted from an article in Scientific American by Jason Gorss, Monday, July 19, 2004*

WHERE DOES WATER COME FROM? WHERE DOES IT GO?

READ AND ANNOTATE

- Take out your Think Aloud Bookmarks, make notes on the text about your reading and thinking.



If you live in a city or town, your home water pipes are linked to underground water pipes. In most cities, these pipes carry water from a reservoir, lake, river, or well to a water treatment plant. There the water is treated to make it safe to drink. From there, it is stored in reservoirs or water towers until you turn on your faucet and the pipes carry the treated water to your home.

TEXT CONTINUES ON NEXT PAGE…

Baths, showers, washing up, washing clothes and toilet flushing all use large amounts of water. These activities transform clean tap water into dirty wastewater. Water utilities collect, transport and dispose of the dirty water after it has been used.

Dirty water or sewage is collected in drains and then is carried by via a network of pipes and tunnels to a sewage treatment plant.

These works use natural microorganisms to remove harmful substances from dirty water. The solid material (sludge) is separated from the liquid (effluent). Sludge can be used as a fertilizer or to produce energy. Treated effluent is released back to the rivers, lakes or the ocean.

Adapted from *http://www.dwi.gov.uk/pubs/tap*

WHERE DOES RUN-OFF GO?

READ AND ANNOTATE

Use ideas from the class discussion about how we read science and your think aloud bookmarks as you read and make notes about your thinking.

Non-Point Source Pollution

Why is some water too dirty for swimming, fishing or drinking? Many of America's most popular beaches are contaminated by floating slicks of garbage, raw sewage, oil spills, fecal bacteria, toxic algal blooms.

The United States has improved aquatic environments by controlling *point source pollution*. Point source pollution enters rivers, lakes and coastal waters from identifiable "sources' or "points" such as outfall pipes from industries and sewage treatment plants.

Unfortunately, we do not do enough to control pollution from nonpoint, sources. Non-Point Source pollution is deposited into waterways by run-off. As rainwater washes over roads, construction sites, animal lots and industrial areas, it picks up oil, salt, grease, pesticides and other pollutants. This runoff usually ends up in a city's storm drains and is released directly into waterways without treatment. t's the main reason that approximately 40 percent of our surveyed rivers, lakes, and estuaries are not clean enough for basic uses such as fishing or swimming.

The most common non-point source pollutants are fertilizer, pesticides, pathogens (bacteria and viruses), salts, oil, grease, toxic chemicals, and heavy metals. Beach closures, destroyed habitat, unsafe drinking water, fish kills, and many other severe environmental and human health problems result from non-point source pollutants.

Adapted from: http://water.epa.gov/polwaste/nps/outreach/point1.cfm

WHAT'S THE STATE OF OUR WATER?

READ AND ANNOTATE

Use ideas from the class discussion about how we read science and your think aloud bookmarks as you read and make notes about your thinking.

Our Polluted Beaches

A 1995 study by the Santa Monica Bay Restoration Project found that people who swim near outfall drains are 57 percent more likely to get sick from pollution-related illness than those swimming in cleaner water.

Rain and sewer water aren't the only causes of beach pollution. In North Carolina, animal waste from large feedlots has been linked to dangerous outbreaks of bacteria. According to Dr. Leatherman, director of the University of Maryland Lab for Coastal Research, poisonous industrial waste makes some water "so black that the waves don't seem like they could break, they're so full of stuff,"

Some communities are improving water resources. San Francisco completed a 20-year, $1.45 billion project on its sewer system to prevent dangerous outfalls. Individuals can also decrease their own impact on water. The National Resource Defense Counsel suggests people use less water, natural soaps and fertilizers, and properly disposes of litter and household toxics like paint and motor oil.

Source: *Adapted from an article from the Editors of E Magazine, April 30, 1999,*
http://www.emagazine.com/magazine-archive/our-beleaguered-beaches

How do humans impact water?

Interactive Notebook

Name: _____
Teacher_____
Date_____

TEACHER GUIDE

Inquiry questions:

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

As we answer these questions, we will also better understand…

4. How do people ***read*** science?

5. How are models ***created***, ***revised***, and ***used*** in

THINKING ABOUT SCIENCE READING

INTRODUCTION. MAKE CHECKMARKS NEXT TO STRATEGIES YOU HEAR YOUR TEACHER USE.

THINK ALOUD CHECKLIST

Setting Purposes

- ❑ I'm interested in …
- ❑ I want to figure out …

Questioning

- ❑ I wonder why/ how/ if…
- ❑ Could this mean …

Predicting

- ❑ I think the next part will …

Picturing

- ❑ I can picture/ imagine/ see …

Making Connections

- ❑ I already knew …
- ❑ This reminds me of…

Identifying Roadblocks

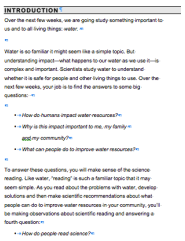
- ❑ I'm confused about …
- ❑ I need to know more about …

Summarizing

- ❑ This is about …
- ❑ The big idea here is …

Using Fix-Ups

- ❑ I'll re-read this
- ❑ I'll mark this and come back



INTRODUCTION

Over the next few weeks, we are going study something important to us and to all living things: water.

Water is so familiar it might seem like a simple topic. But, understanding impact—what happens to our water as we use it—is complex and important. Scientists study water to understand whether it is safe for people and other living things to use. Over the next few weeks, your job is to find the answers to some big questions:

- *How do humans impact water resources?*
- *Why is this impact important to me, my family and my community?*
- *What can people do to improve water resources?*

To answer these questions, you will make sense of the science reading. Like water, "reading" is such a familiar topic that it may seem simple. As you read about the problems with water, develop solutions and then make scientific recommendations about what people can do to improve water resources in your community, you'll be making observations about scientific reading and answering a fourth question:

- *How do people read science?*

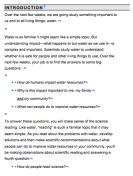
INTRODUCTION TO WATER UNIT *READER R2*

INTRODUCTION

Make checkmarks next to strategies you hear your teacher use while thinking aloud about the "Introduction"

OUR READING STRATEGIES	HOW THEY HELPED US READ

Use this lesson to help students identify the purpose of these reading strategies – that as we read, we're identifying the strategies that help us do that reading, which will help us help us think more deeply about the text, what we know, and what new understanding we can gain



THINK WRITE, PAIR SHARE *READER R2*

You might already know a whole lot about our essential questions: water and how humans impact this important resource. Use the space below to first record your initial answers to the first 3 essential questions. Then, share these ideas with your partners, and then, your class.

<u>THINK WRITE</u> - My initial ideas about the essential questions:

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

Use this lesson to draw out Ss' prior conceptions about how humans impact water. They might say things like humans *throwing stuff into the water*, such as 'toxic materials' and trash. This is a great time to benchmark where the students thinking is at currently. You can accept all possible answers at this point, but be sure that as student move forward, they are increasingly drawing on textual evidence to change their ideas about how humans are impacting water.

PAIR SHARE - Norms for pair share:

Speaking Pair share your ideas about the essential questions above

- One thing you are confident about, as you think about how humans impact water
- Something that you are unsure about, or something you have questions about

Listening Pair respond to your pairs' ideas

- What you understand really well about how humans impact water
- What is unclear to you about how humans impact water
- Before switching, make notes about new ideas you have for how humans impact water

Remember to use draw on the information from the text to support your critique or praise of one another's work!

WHOLE CLASS SHARE - Share you and your partner's ideas with the class.

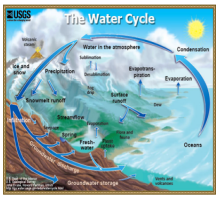
WHAT'S IN OUR WATER?

Scientists "read" when they observe and collect data about the world. When they write about their observations, questions and thinking, the writing becomes a science text.

- Observe how you and others use water over the next 24 hours. Write notes about your observations in the evidence column, below.

Evidence I saw…	Interpretations I thought… I wondered…	
What do people <u>use water for?</u>	**What is <u>in</u> the water people use?**	**How <u>safe</u> is the water people use?**

The first HW for students is to go home to observe and collect evidence about how they or others use water for 24 hours. This is the first and only time students are collecting evidence first hand, through "investigation" rather than through texts. You may want to emphasize here that scientists privilege the collecting direct evidence (so they can be more sure of what they see, the methods of collecting data, etc) rather than relying on text – but that both can and are used as sources of evidence for scientists



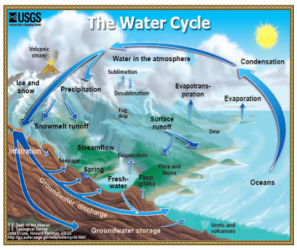
WHAT HAPPENS TO WATER IF WE DON'T' USE IT?
READER R3

Add notes to the Reading Strategies List after using your reading strategies to read "what happens to water if we don't' use it?"

OUR READING STRATEGIES	HOW THEY HELPED US READ

We emphasize reading strategies here again to reiterate the fact that we can 'read' a worksheet – noticing the headings, tables, anticipate what we're going to be doing, etc. so it can become an automatic practice over time for students.

IN addition, you can push for students to draw on what they have learned in the mini modules unit and incorporate these into their reading strategies. For example, looking for signs of the kinds of processes or explanations that are conveyed in the model (noticing arrows, vocabulary, placement of text, etc). Noticing these features of models is yet another way for Ss' to expand on their toolkit of reading strategies.



WHAT HAPPENS TO WATER IF WE DON'T' USE IT?

READER R3

Scientists draw on texts – both written text and visual models, to help them build new understandings about the world around them. One important way to do this is to identify evidence in the text that helps them answer their inquiry questions. Below, identify the evidence that helps you better answer the essential questions. Then, make interpretations from evidence, and ask yourself what else you need to understand to help you address the essential questions.

EVIDENCE What we saw in the text	**INTERPRETATION** What we thought about it	**NEXT STEPS** What we think we know or need to know now

To make sure that Ss' are attending to evidence that helps them make progress on the essential questions, you may want to review the three content essential questions (1-3) before asking Ss to find evidence and make interpretations. Often times, these interpretations can be unrelated to the essential questions – these are okay, but try to rein students in and reiterate that <u>each of these texts are helping us answer the essential questions</u>

What important key ideas did you gather from this model?

What additional questions do you have about this model?

THINK WRITE, PAIR SHARE ABOUT MODELS

COLLABORATIVE PEER REVIEW—PAIR TO PAIR

Scientists often build and revise models to help them keep track of their ideas. In this unit, we will do the same! As you encounter more and more texts, we will be using modeling to help us better understand the movement of water and how humans impact the water. First, take some time to think about what components this model should have. Then, share these ideas with your partner and then the class.

THINK WRITE - My initial ideas about what needs to be included in the model:

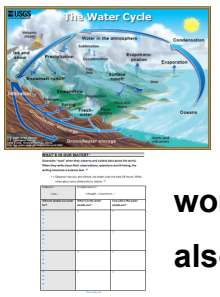
PAIR SHARE – What components does your partner think needs to be included?

To scaffold the first modeling task, we have students share out ideas about what should be included if we build a model that helps us answer the essential questions. Some of the important components to think about:

- Keeping track of *where* water goes, and the flow of water on Earth
- Explaining *how* humans impact water (push for specificity here – how we positively or negatively impact the water. Ss may also already think that we are polluting the water – push for Ss' to describe *how* and *in what ways*.

This discussion helps Ss hone in on the processes and mechanism

WHOLE CLASS SHARE - Share you and your partner's ideas with the class.



SCIENTIFIC MODELING *READER R2, R3*

As you learned in the mini modeling unit, scientists use models to help them better understand the science that is going in the world around them. In this unit, we will not only read models, but also build them as we read more and more texts about how humans are impacting water. Below, record the class consensus model that represents our ideas so far.

What makes a good scientific model?

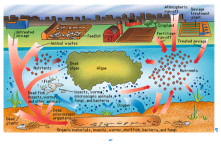
Our consensus model

This is the first opportunity for students to generate the consensus model. To make sure it hones in on processes and mechanisms, this should be a whole class activity. They may need some help in thinking about what to include, etc. Refer them back to the mini modeling unit to identify what makes a good model.

Make sure that the class is on the same page about what they are trying to represent through this model, based on the textual evidence they have found (focusing right now on the path that water takes through the water cycle) and that they will be adding to this as they get more information about how humans impact the water cycle (and that they need this information to create model that helps them answer the essential questions

What questions does your class still have about the model?

What else do we need to know to answer our essential questions?



HOW ARE HUMANS IMPACTING WATER? *READER R4*

Use the reading strategies we have learned so far to read this text "how are humans impacting water?" As you read, make annotations on the text, looking for evidence of how humans impact the flow of water you saw in the previous text "the water cycle". Do some thinking on your own, and then pair up and share your ideas.

THINK WRITE – Find evidence from this text that helps you think about *how are humans impacting water.* How is the same or different than your previous ideas?

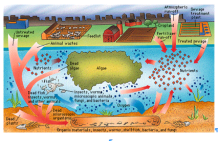
PAIR SHARE – What evidence di
or different than the ones you four

WHOLE CLASS SHARE - Share
text with the class.

As the case with all the texts in this module, each time Ss' engage with the text, they should do so with the goal of finding out more about how humans impact water. In this think write/pair share, Ss are explicitly looking for evidence about how humans impact water and juxtaposing them against their prior ideas. These ideas may be the same or different than the ones Ss' put forth as they answered the essential questions on page 4.

You may also need a discussion about what evidence is – some key ideas that you may want to emphasize are:

- Evidence is something we see in the text
- Interpretations are something we gather as we draw on the evidence (but are note explicitly in the text itself)
- For scientists, evidence typically involves gathering data (like what the Ss' did on page 6 "what's in our water")
- For scientists, evidence also involves looking at texts. They must do this carefully though, and often times look at more than one text to make sense of scientific phenomena (in this case, how humans impact water)

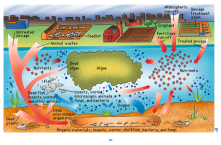


HOW READING STRATEGIES HELP US

We have been using reading strategies to help us identify evidence in each of the texts we encounter. These pieces of evidence can help us better understand how humans impact water. Record any new strategies that you, your partner, or your teacher uses that helps you make sense of the text.

NEW READING STRATEGIES	HOW THEY HELPED US READ

To monitor how Ss' ideas about reading science texts are changing over time, you can solicit the new strategies Ss' come up with as they engage in subsequent texts. This helps remind them of the cognitive work they are doing each time they encounter a text.



HOW ARE HUMANS IMPACTING WATER?

EVIDENCE AND INTERPRETATION NOTES

Make notes during the class discussion

EVIDENCE	INTERPRETATION	NEXT STEPS
What we saw in the text that helps us answer the essential questions	What the evidence suggests should include in our consensus model	What we think we know or need to know now, given the available evidence

This is a very important piece of evidence that begins to help students see how humans might be impacting water. This text has many arrows and difficult vocabulary -- help students attend to these components and ask questions about what they might infer from these features of the model.

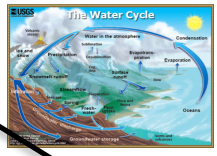
Some helpful prompts:

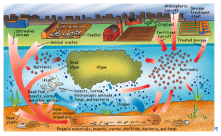
- What do the arrows mean? Is it the same or different than the water cycle model we saw earlier?
- What kinds of things are entering into the water? Where are they coming from?
- What are nutrients? Aren't they suppose to be good for you? Where are those nutrients going and how do you think it affects the organisms living in the water? And us? "
- Do people just throw fertilizer and sewage into the water on purpose? How do these things get into the water?

In this discussion, push for Ss' to draw on their prior knowledge and support them in sorting out whether or not the textual evidence supports or refutes their ideas.

SCIENTIFIC MODELING

READER R2, R3, R4





Based on the evidence from the texts we just read, your pair and class discussions, draw the class consensus model below of how humans impact water.

Remember, models should…

- _____
- _____
- _____

Class consensus model

Help students identify the purpose of models. Make sure you are drawing the answers out of them, not reciting these ideas to them.

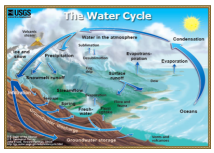
Remember, models should…

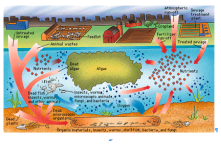
- explain, predict, and understand scientific phenomena
- Be ***updated*** to reflect the new evidence or understandings we get from the readings
- Help us answer our essential questions

Help students attend to the top of their worksheet, which indicates the texts they have read, to help them make cross-text comparisons and synthesis of information provided in each.

The Reader pages are also included in the gray box, on the right hand side. All texts are numbered with "R_" to avoid confusion with the Interactive notebook

ESSENTIAL QUESTIONS *READER R2, R3, R4*





ANSWER THE QUESTIONS THAT YOU CAN NOW, BASED ON THE READING SO FAR.

1. How do humans impact water resources?

> This is an opportunity for Ss' to articulate any changes they have in their thinking about how humans impact water or how scientists read texts. Push Ss' to think about how their thinking has changed after they have:
>
> 1. Collected data from their homes about what's in their water
> 2. Looked at 2 models – one of how water moves in the Earth and the other about how humans impact the water

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

4. How do people read science?

5. How are models ***created***, ***revised***, and ***used*** in science?

WHAT'S IN THIRD CREEK? WHAT'S IN THE CHICAGO RIVER?

READER R5, R6

READING STRATEGIES LIST

We have been using reading strategies to help us identify evidence of how humans impact water as we encountered written text, scientific models, and now, pictures. Write down any new reading strategies that we can use to help us identify important pieces of evidence in these texts.

NEW READING STRATEGIES	**HOW THEY HELPED US READ**

Both of these texts are photographs, so it may be helpful for students to do a quick preview of both, and figure out what new reading strategies they might use while reading both of these texts. At this point, Ss will have read a variety of texts and may identify different strategies for each:

- Written text
- Scientific models (visualizations of processes)
- Pictures

WHAT'S IN THIRD CREEK? WHAT'S IN THE CHICAGO RIVER?

READER R5, R6

EVIDENCE AND INTERPRETATION NOTES

EVIDENCE What we saw in the text that helps us answer the essential questions	**INTERPRETATION** What the evidence implies about how humans impact water	**NEXT STEPS** What we think we know or need to know now, given the available evidence

Again, as Ss engage with each text, help frame this task as a way for them to engage in the work of gathering evidence that addresses their essential questions

EVIDENCE AND INTERPRETATION NOTES *READER R7-8*

WHAT'S IN YOUR LEMONADE?

Make notes during the class discussion

http://water.epa.gov/aboutow/owow/videocontest.cfm#winners

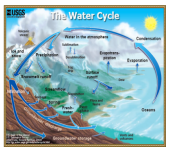
EVIDENCE	INTERPRETATION	NEXT STEPS
What we saw in the video that helps us answer the essential questions	What the evidence implies about how humans impact water	What we think we know or need to know now, given the available evidence

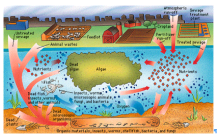
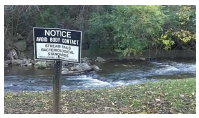
This is the first time that video is used in the unit. The video goes by quick, so Ss' may need to view it a couple of times. There is no new content information in the video – **use this as an opportunity to reiterate the idea that water flows through various locations** (through dirt, groundwater, sewer systems, rivers, back into our homes) and push Ss' to think about the state of water as it travels. Is the water the same when it gets into our home as when it enters a sewer? Is it safe for us to drink?

Viewing tips:

- Have Ss' watch the video all the way through
- Call attention to the video freeze frames (on Reader R7-8)
- Have Ss' view the video a couple of more times, taking notes on next to the frames in the reader, and then come together to record evidence/interpretation/next steps, drawing on these notes

SCIENTIFIC MODELING *READER R2-8*

In class, we have been using our reading strategies with multiple types of text, looking for evidence that helps us better understand how humans impact water. When scientists encounter new pieces of evidence, often times they need to go back and update their models, using this new information. Drawing on your knowledge of our previous consensus model (p. 16 of this packet), and all of our additional pieces of evidence, think about what new components need to be added to the model. Then, as a class, construct your consensus model.

THINK WRITE – What new evidence do we have that helps us better understand *how are humans impacting water?* What new components do we need to add to our model?

Models should help us….

> Now that we have done the consensus modeling together (twice), support Ss' in doing this first portion on their own – identifying evidence they have gathered so far and how it should be incorporated into their models. It may be helpful for Ss' to reference the class consensus model to help them identify what new components should be added.

New evidence from the readings tells me that….

We should revisit our model and update it by…

Class consensus model

What questions does your class still have about the model?

What else do we need to figure out to answer the essential question?

EVIDENCE AND INTERPRETATION NOTES

READER R9

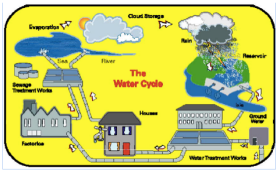
WHAT'S IN THE WATER AT THE BEACH?

First, discuss with your partner what kind of evidence you are looking and the kinds of interpretations you would like to make about that evidence. Then, read the text by yourself, using the reading strategy checklist.

EVIDENCE	INTERPRETATION	NEXT STEPS

See if Ss are able to 1) use their reading strategies to identify what the reading is about, important things to attend to, and 2) if they can use the reading strategies on their own, or with partners. Try to scaffold this process so that they can become independent users of these strategies, and thus, independent readers.

To reiterate that they are looking for evidence that helps them answer the driving question, have them fill in the blank spaces below evidence/interpretation/next steps



WHERE DOES WATER COME FROM? WHERE DOES IT GO? *READER R10-11*

MAKING COMPARISONS OF SCIENTIFIC MODELS

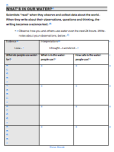
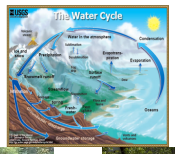
In the 'Reading science models' unit, we began to look at different scientific models and brainstorming what makes a good scientific model. Often times, evaluating models is not a simple task because models can be created to convey different kinds of information. First, read the text "where does water come from? Where does it go?" Then, compare the model in this text and describe how it is *similar* or *different* than the one that we have built. Finally, think about what new information we can get from this text to update our model to help us answer the essential questions

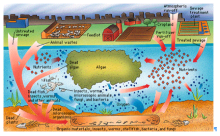
HOW IS THIS MODEL SIMILAR TO OUR CONSENSUS MODEL?	HOW IS THIS MODEL DIFFERENT THAN OUR CONSENSUS MODEL SO FAR?

MODELING: It's important to point out here that we've been building models, but we can also use models as texts that provide new information and evidence. Here, instead of our usual evidence/interpretation/next steps table, we make explicit how this model is different or the same as the one that we have been building. Read the model alongside the text that is below it to help students make connections between the model and the text

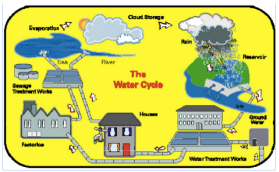
HOW HUMANS IMPACT WATER: So far students have evidence that fertilizer, sewage etc. enter into the water, making us sick through outfall pipes. This text introduces the pathway of water that cleans the water – and makes it 'safe' – it is important to distinguish between two pathways at this point, because this will be an important addition to the model

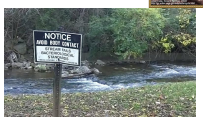
ESSENTIAL QUESTIONS *READER R2-11*

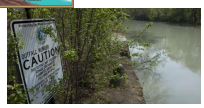













ANSWER THE QUESTIONS THAT YOU CAN NOW, BASED ON THE READING SO FAR.

1. How do humans impact water resources?

2. Why is this impact important to me, my family and my community?

3. What can people do to improve water resources?

4. How do people read science?

5. How are models ***created***, ***revised***, and ***used*** in science?

WHERE DOES THE RUNOFF GO? *READER R12*

We have been talking about how humans impact water, and getting more and more evidence from each text we read. With this text, use your reading strategies checklist to find new pieces of evidence that helps us answer the essential questions. Then, share with your partner and the class

THINK WRITE – Find evidence from this text that helps you think about *how are humans impacting water.* How is the same or different than your previous ideas?

PAIR SHARE – What evide
or different than the ones y

WHOLE CLASS SHARE -
text with the class.

This reading contain important pieces of evidence that help students think about the causal mechanism of how sources of pollution enter the water. You may want to have students read this first individually and then together as a class to draw on the important information that you want the students to be aware of as they go into the consequential task.

Important things to note here:

- Water goes through sewage treatment plants, where it is cleaned
- Water also flows on the surface, as runoff, picking up oil, grease, etc. and goes into the waterways (rivers, lakes) untreated. This is what causes the water to be unclean. This is non-point source pollution
- Water is also polluted through point source pollutants – through outfall pipes from treatment plants.

WHERE DOES THE RUNOFF GO? *READER R12*

EVIDENCE AND INTERPRETATION

Using your think write, pair share and whole class discussions, first determine what kind of evidence you are looking for in this text, Then, identify the evidence and how that evidence helps you answer the essential question. Finally, write out the additional questions you have after reading this text.

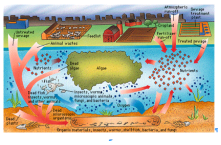
EVIDENCE	INTERPRETATION	NEXT STEPS

To reiterate that they are looking for evidence that helps them answer the driving question, have them fill in the blank spaces below evidence/interpretation/next steps

EVIDENCE: parts of the text that helps us understand how humans are impacting water

INTERPRETATION: what we understand about how humans impacting water

NEXT STEPS: additional questions, what we know now, what we need to know about how humans are impacting water



HOW ARE HUMANS IMPACTING WATER? *READER R4*

Often times, scientists have to read texts multiple times to *really* understand them. We have read so many texts about how humans impact water, it's time to go back to one of the important texts from the beginning of this unit, "How are humans impacting water?" Take this time to notice things you did not notice the first time around, and answer the following questions:

1. What new pieces of evidence do you notice now, that you did not notice before?

2. How does this new i

> This is an opportunity for Ss to return to the model that they encountered in the beginning of the unit. They should take some time to notice processes, vocabulary, that came up in many texts that they also saw in this model. You can have Ss do this individually or do this whole class.
>
> Helpful prompts:
>
> - What did we notice before about this text?
> - What do the arrows stand for?
> - Where are pollutants entering the water? Did we find evidence for this in other texts?
> - How did the texts we read help us look at this model differently?
> - What new evidence do you gather now, as you look at it for the 2nd time?

3. How did you read this text *differently*, now that we have gained new understandings about how humans impact water?

WHAT'S THE STATE OF OUR WATER *READER R13*

Carefully read and annotate this text. Then, share with your partners about what new pieces of evidence. Think about how this new information helps you answer the essential questions.

What new information did you find?

What essential questions does this help you answer?

ESSENTIAL QUESTIONS *READER R2-13*

ANSWER THE QUESTIONS THAT YOU CAN NOW, BASED ON THE READING SO FAR.

1. How do humans impact water resources?

2. Why is this impact important to community?

This is the final time that students answer the essential questions before constructing the final consensus model and makes a recommendation in the consequential task. Make sure that at this point, students can:

- **Describe the water cycle** (the flow of water) through its natural habitat
- **Describe the ways in which humans influence the water cycle** by both point and non-point sources of pollution

3. What can people do to improve water resources?

Lastly, think about what you have learned about how scientists read and use models in their work:

4. How do people read science?

5. How are models ***created***, ***revised***, and ***used*** in science?

SCIENTIFIC MODELING *READER R2-13*

Generate the class consensus models for water based on the readings so far.

Remember, models should…

- _____
- _____
- _____

Class consensus model

This is the final consensus model for the unit. As Ss work to construct the final model, have them focus on the new evidence they have gathered, how they should incorporate this into their existing model, and reflect on whether or not the model completely helps them explain how humans impact water

You can also use this opportunity to return to the criteria Ss' built in the mini modeling unit about what makes a good scientific model, and use this to help them evaluate the class consensus model

CONSEQUENTIAL TASK

Recommendation task: What can we do about this problem of impact?

Since the beginning of this unit, we've been thinking about how humans impact the water cycle. Now it's your turn to take this information and generate a solution to the human impact that we have on the water cycle.

Based on the texts (and the evidence within them) and also the model that we have generated based on these texts, make a recommendation of what can be done to address this problem of human impact. Use th you generate your solution.

> You may want to have students use their reading strategies to 'read' the directions for the consequential task

A. As you create your solution, you should include….

1. **Problem statement** (text based)
    a. How do humans impact the water cycle?
    b. What evidence do you have that this is a problem (remember to draw on the evidence, interpretations and models you have been gathering so far in this module)
2. **Solution statement**
    a. What is your solution?
    b. What supports your solution? (you should be able to point to evidence, interpretations or the model you have been generating in this module to support your solution)

B. Make use of all that we've been learning!

We've been building a model all along this unit – how could this model help us in making our recommendation?

Recommendation task: What can we do about this problem of impact?

Write your solution in the space below…

- The problem is….
- My solution is….
- I think this will help address how humans impact water because…. (draw on evidence that we have been collecting throughout this unit!)
- My solution is based on…

These suggestions (A & B) push Ss to make connections between the **casual model** that they have been working to create and their recommendation. One way of helping students draw on models is to ask: where in this model (i.e. arrows, locations, etc) does your solution sit? What problem is it trying to solve?

Water Unit

FRONT MATTER - TEACHER INFORMATION

FRONT MATTER - TEACHER INFORMATION

INSTRUCTIONAL GOALS

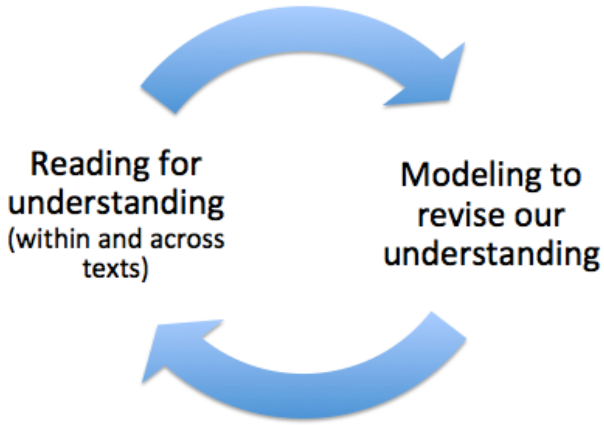
Students will develop dispositions to engage intellectually with text in gradually more scientific ways as defined by the READI science constructs.

1. Students will engage more actively and intellectually with a variety of texts across multiple genres and representations, as evidenced by:
    a. Increases in metacognitive annotations on text that demonstrate a widening range of strategies and more persistent and productive meaning making across a text
    b. observed use of strategic scientific reading processes while thinking aloud
    c. observed reductions in time to task when prompted to read, and
    d. observed increases in time on task when reading.
2. Students develop capacities to read scientifically (use text-based information and/or evidence within and across texts to make claims and reason about the implicit scientific warrants for their claims using the consensus model criteria) as evidenced by:
    a. annotations on text and/ or
    b. written work in interactive notebooks and/or
    c. participation in classroom discourse:

Things you will need:

- **A way to project *and annotate* texts as you model**
- **Your modeling prompts, based on text notes you prepare in advance**
- **Interactive notebooks and readers for each student**
- **Highlighters, pens, and sticky notes for students to share**
- **Whiteboards for each group and for the class to share**

LOGIC MODEL



1. By closely ***reading in advance of instruction*** and thinking metacognitively about their own science knowledge and expert science reading approaches with each text, teachers develop knowledge of the science content as well as what each text affords for literacy instruction for each text and what may challenge his or her students while reading.
2. When teachers ***read with, not for students***, they support students' agency and efforts to engage, identify and solve problems and comprehend text
3. To accomplish this kind of "minds on" engagement with reading and thinking about reading, teachers use ***reciprocal modeling***—in brief, frequent turns with students modeling thinking and problem solving—starting with student's thinking and questions.
4. Through ongoing ***metacogntive conversation***s about how to make meaning and what meaning they make of texts, students develop dispositions and skills to engage with reading for understanding in science (as defined by READI) over time.
5. By engaging students in **identifying evidence** and **generating interpretations** across texts, students become increasingly aware of the kinds of evidence contained within each texts, and adept and generating scientific claims based on that evidence
6. By **generating**, **revising**, and **coming to consensus** on a **scientific models**, students use modeling as a metacognitive tool that enables them to think about how the evidence from each text provides new information and how to represent those new understandings through scientific representations
7. By **engaging in consensus-building discussions**, teachers and students are able to model the scientific processes of asking questions, obtaining evidence, and revising their understandings through the use of models

This unit relies on key instructional practices and iterative learning routines organized in cycles of instruction that gradually increase in difficulty. These are explained in more detail in the pages that follow.

Key Instructional Practices (reading for understanding)

Reading to Prepare for Reading Instruction

To prepare for teaching a text-based lesson, teachers read and metacognitively annotate their text with key questions in mind about goals for literacy development, all in the service of the big question: How can I support my students' thinking and efforts to comprehend the reading without explaining the content? Questions to guide this metacognitive reading preparation are:

- What do I know about text structure, language, the science practices and discourse that help me make sense of this text?
- What goals do I have for developing my students' schemata about text, language, science as a discipline and this topic that this text might support?
- How do I make sense of this text? What processes do I use to engage and problem solve? What roadblocks do I encounter or recognize? How do I solve them?
- What is and is not explicitly in the text? What leaps of reasoning or outside resources might my students need?

Read With, Not For

To support active intellectual engagement with reading and meaning making, teachers refrain from explaining and reading aloud to students or having students read aloud in turns for the class. Everything is treated as text to read, including directions, texts in the readers and students' work. The routine of Think-Write, Pair, Share is a support for both students and teachers as the class develops new discourse practices and habits around reading. The routine looks and sounds like the discourse pattern in the table below:

Teacher introduces the text	"Please open your reader to page ____"
Students locate the text in their readers	
Teacher establishes or reinforces the norm that students are in charge of reading and sense-making	"Please read the directions to your partner and explain them to one another"

Teacher establishes/ reinforces the norm that reading means making sense, understanding the text	*What questions do you have about what we are about to do?* *Who can explain what they understand about what we are to do?*

	Does everyone agree with that explanation?"
Students share roadblocks, questions and their gists (informal summaries) of what they understand	*Student: What does annotate mean?*
Teacher supports peer-to-peer problem solving as needed, based on in the moment assessment of student identified roadblocks and students summaries of what they understand	See Reciprocal Modeling, below

Reciprocal Modeling

In reciprocal modeling, the teacher models and guides practice in turns with students, gradually releasing students to more independent and collaborative problem solving by increasing peer to peer discourse about how to make meaning and what meaning they are making. The teacher's models are based on her or his in the moment assessment of students' confusions and (emerging) understandings. This classroom discourse takes the form of routine and frequent metacognitive conversations as students encounter and make sense of content within and across texts in the unit.

Metacognitive Conversations

Metacognitive conversations are focused on reading processes. In science, scientific reading processes: Both how we use schema about text, language, scientific practices and the content and how we use strategies to engage, re-engage, monitor comprehension, solve problems and finally come to understand texts. The goal of metacognitive conversations is to teach students to develop control over their own engagement and reading processes while actively involving them in the processes of making meaning of the content.

Reciprocal Modeling and Metacogntive Conversations work synergistically in the classroom and might look and sound like the discussion below:

Teacher invites students to discuss their reading and thinking after they read the first set of directions on the first text "Five things you'll need."	*What questions do you have about the directions or what we are about to do?*
Students share roadblocks, questions	*What does 'connections' mean?*
Teacher supports peer-to-peer problem solving as needed, based on in the moment assessment of student identified roadblocks and questions	*"Did anyone else have the same question?* *Who had an idea of what that might*

	mean?"
IF students seem unable as a group to solve the problem or answer the question, the teacher offers a model, thinking aloud and annotating a projected copy of the text.	*I'll model a connection.* *When I look at the pictures on this page, I see the highlighters and I make a connection to the basket of highlighters on the tables.*
and their gists (informal summaries) of what they understand	*How did you figure that out?* *Who can explain what they understand about what we are to do?* *Does everyone agree with that explanation?"*

Core, iterative Learning Routines

These routines spiral in iterative cycles across texts. These structures are: Think Aloud; Reading Strategies List; Evidence & Interpretation; Sketching to Make Meaning; Consensus Model; Essential Questions; Scientific Claims; Scientific Recommendations. These structures along with the embedded prompts, instructional practices, interactive notebooks and consumable readers provide numerous scaffolds and supports for reading, thinking and talking about reading.

Think Aloud

Think aloud is a process of verbalizing what one thinks while reading. The key to successfully deepening students skill and noticing and controlling their reading and thinking processes is careful reading to prepare for reading instruction and strategic use of the think aloud book marks during reading and reciprocal modeling. Think aloud is a dynamic assessment and differentiation strategy, therefore, there is no one "right" place to start or correct order of instruction and mastery. Rather, the order is determined by the interaction of readers and texts—by what readers need and can do with each particular text.

Reading Strategies List

The reading strategies list serves as a shared text that captures what the class knows how to do and is learning to do while reading across science texts. Over

time, it represents a developing concept of what reading science is. The reading strategies list is anchored on the think aloud bookmarks but over time becomes more elaborate and extensive. Like a word wall, the reading strategies list also provides a common reference and reminder of what the class has learned to do when reading.

Key Instructional Practices (scientific practices & modeling)

Evidence & Interpretation

These note takers are thinking spaces—think messy drafts in progress-- to support reasoning first within and then across texts. The texts are carefully selected and ordered to elaborate concepts as students read and reason across texts. Helping students to identify, record and keep track of connections across texts will support scientific reasoning needed to construct models and finally make scientific recommendations in the culminating task.

Sketching to Make Meaning

We conceptualize summarizing as a multi-step, non-linear process. Sketching is a step along the way to summarizing and modeling that supports students to actively involve in sub-processes of summarizing and the messy work of coming to a “gist” – a representation of the big ideas or an informal summary. First, students identify important details. They reason about the big ideas and then sketch their “gist.” As they do so, they identify gaps or inconsistencies in their understanding, re-read to clarify, develop new gists (erase!), sketch new gists, identify new roadblocks or gaps, re-read, clarify (erase), sketch… Whiteboards here are helpful as they invite permission to erase and revise.

Scientific models (students' and the class consensus model)

Scientific models play an important role in science as a way of communicating and depicting important processes or mechanisms for underlying phenomena (models of photosynthesis, DNA replication, etc). They also play an important role in helping scientists make predictions (computational models) for real-world phenomena. In this module, students will begin engaging in the process of generating and refining models as they get more and more evidence from the texts that are provided within the module. Generating and revising models is a key way of keeping track of students' current understanding about the processes within the water cycle and the impact that humans have on this cycle as we continue to collect more data over time. There are *multiple* opportunities within this module for students to return to their model and update it, using new evidence from the text. As teachers, you may see the need for more or less opportunities to do this work. At each of these points, the students will have the opportunity to generate their own model, share and critique each other's, and come back together to create the class consensus model. Generating consensus models fosters productive conversations involving the whole class, and makes visible the process of building new knowledge together.

As you revisit and revise the consensus model for the class, keep these things in mind:

- What new evidence did students identify in the text? How does this new information warrant a need to update the consensus model?
- What kind of notations do you want to establish as a class (i.e. ways of depicting process, ways of indicating direction, etc)? Making sure that the same notations are used will help keep the model simple, and understandable
- What features are really important to capture (or not)? Because models can't depict everything, its important to engage students in conversations about what to put inside the model, the reason it should be included (drawing on evidence from the text) and how it should be depicted.

- Lastly, it's important the model that is generated and continually revised helps us answer the essential questions that frame this unit. It will become an important tool of support for students in completing the consequential task that is the summative assessment for this module

Essential Questions & Scientific recommendations

Essential questions, or "driving questions" are what drives scientific investigations. Scientists conduct investigations to answer a question. Often times, these questions are about important disciplinary ideas (i.e. natural selection, homeostasis in biological systems), and come out of a need to understand scientific phenomena and to take a course of action. In this unit, the essential questions encompass both of these dimensions: 1) students should be able to understand the processes underlying the water cycle and how humans impact this cycle, and 2) be able to use this information to make an informed decision about an interventions that will impact this cycle in someway.

Often times, the danger in asking students to make a decision on a social, political or practical matter is that this decision may not require science evidence. In this module, we paid careful attention in choosing the right texts and providing the appropriate scaffolds for the modeling work to try to ensure that when the essential questions are answered, students are armed and ready with the evidence and interpretations they have gained so far from the text to ensure that students make their recommendations based on evidence. This is a hallmark of the disciplinary practices of scientists – gaining new understanding and informed decisions based on the best available evidence.

Scientific Claims

Scientific claims are knowledge statements about what we know about scientific phenomena, based on our evidence. Claims can be generated to explain phenomena (i.e. the water cycle does….) or they can be recommendations (i.e. To address this problem, I think that we should…) In order for these claims to be *scientific*, they should be supported by evidence. Claims are not easy to generate – scientists are careful about the claims they make,

because often times different individuals will make different claims, drawing on the same data. Thus, claims inherently require a level of interpretation. As you support students in interpreting the evidence from the text, it may be helpful to push students in articulating their thought processes behind their interpretations.

In the teacher manual, we include important notes that overlay these pages to help guide your work in supporting students in doing this work.

Helpful information about lesson will be inside these text boxes.

Date _____

Name _____

Introduction

Scientists have collected data that prove that Earth is warming up. Scientific models and experiments show that increasing amounts of carbon in the atmosphere causes this warming. One of the most important scientific questions today is *"How are humans impacting the carbon cycle and what can be done about it?"*

In your folder are four texts that will help you understand the carbon cycle and how humans are impacting it.

Your Tasks

1. Read the texts in your folder and write notes in the margins about your reading, thinking and problem solving processes.

2. After you have read the texts, respond to the following,

    - Use information from the texts to create a detailed model, using visuals (pictures, diagrams, graphs, etc…) and words that explain how humans impact the temperature of the Earth.

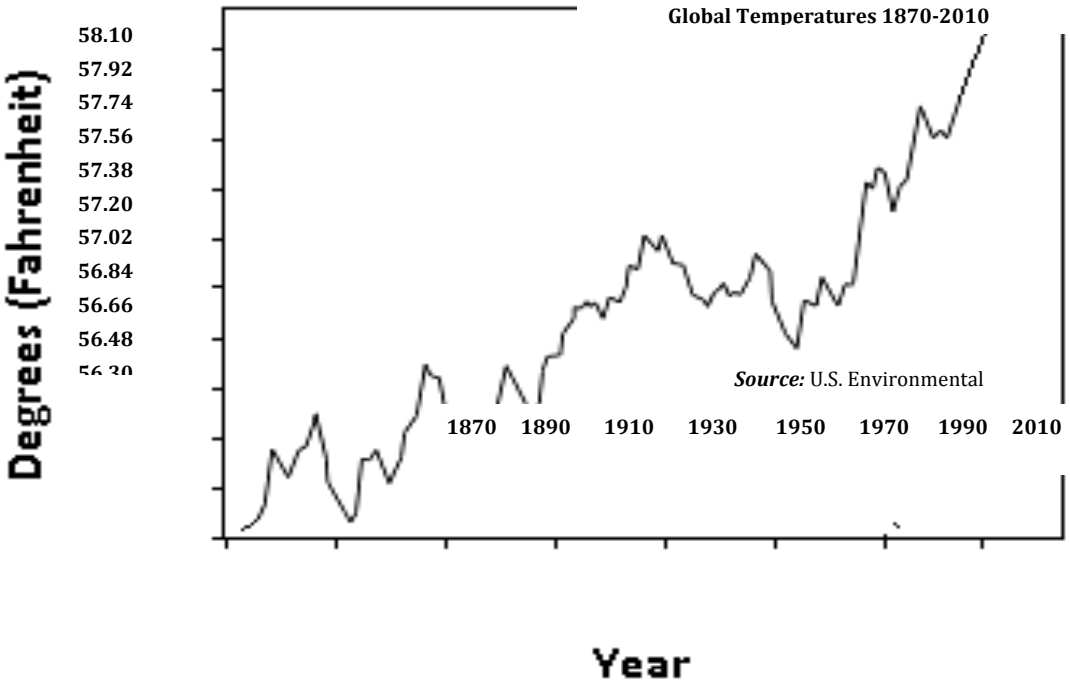
- You can read the texts in any order you wish.
- The information in the texts will help you create your model.
- When you have finished reading and writing notes on the texts take the blank paper that is in your folder and use it to create your model.
- You can look at the texts and your notes when you are creating your model.

Name _____

Changes in Global Temperatures

The temperature of the land and the oceans is measured by weather stations all over the Earth. Scientists have access to all of this temperature information. At the end of the year, they take the average of all of these temperatures. This average is called the global temperature of the Earth. Small changes in the average global temperature create big problems for living things. A recent study by the Royal Society of biological sciences found that warmer temperatures are related to higher extinction rates. *

Scientists have recorded temperatures around the globe since 1880. The graph below is a visual model made using this data. It shows the average global temperature of the Earth from 1880 to 2010.



* doi: 10.1098/rspb.2007.1302 *Proc. R. Soc. B 7 January 2008 vol. 275 no. 1630* 47-53

Name _____

Carbon Balance

Carbon is the backbone of life on Earth. We are made of carbon, we eat carbon, and our economies, our homes, our transportation all use carbon. On Earth, carbon is stored in the ocean, the atmosphere, in living things, and in the earth as rocks, soil, and fossil fuels. We call places that store carbon "sinks."

Carbon moves between sinks through the carbon cycle. Carbon can be moved out of one sink and into another, but it never gets destroyed or goes away. For example, when people use gasoline in their cars, they are moving carbon from the lithosphere to the atmosphere.

Carbon dioxide is gas made up of one atom of carbon and two atoms of oxygen. Carbon dioxide traps heat in the atmosphere. Without it and other carbon gases, Earth would be a frozen world. When there is more carbon in the atmosphere, the Earth warms.

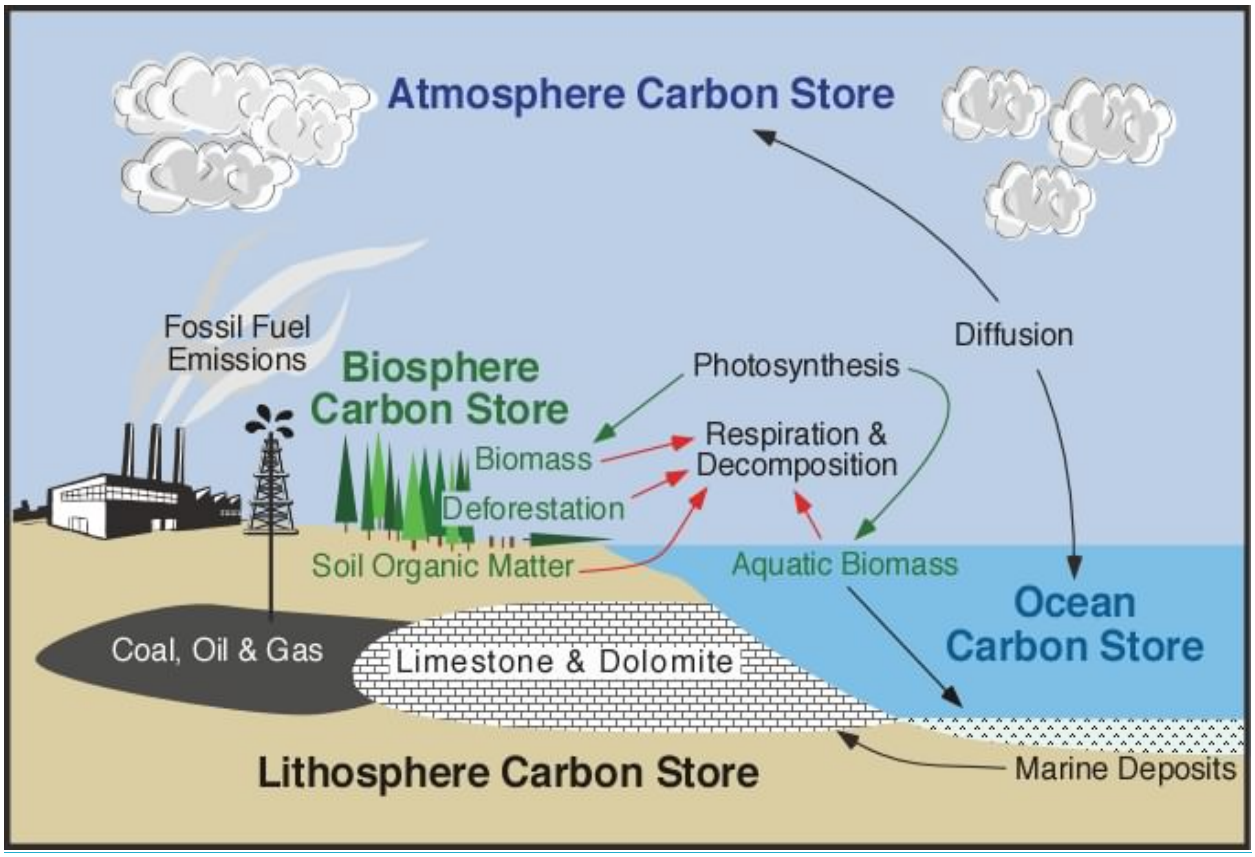
Name _____

Carbon Sinks

The diagram below is a visual model of the major carbon sinks, or "stores".

Carbon is found:

(1) in living things in the ***biosphere;***
(2) as the gas in the ***atmosphere;***
(3) in soils in the ***geosphere;***
(4) as fossil fuels and rock in the ***lithosphere***
(5) in the oceans, or ***hydrosphere.***



http://www.physicalgeography.net/fundamentals/9r.html

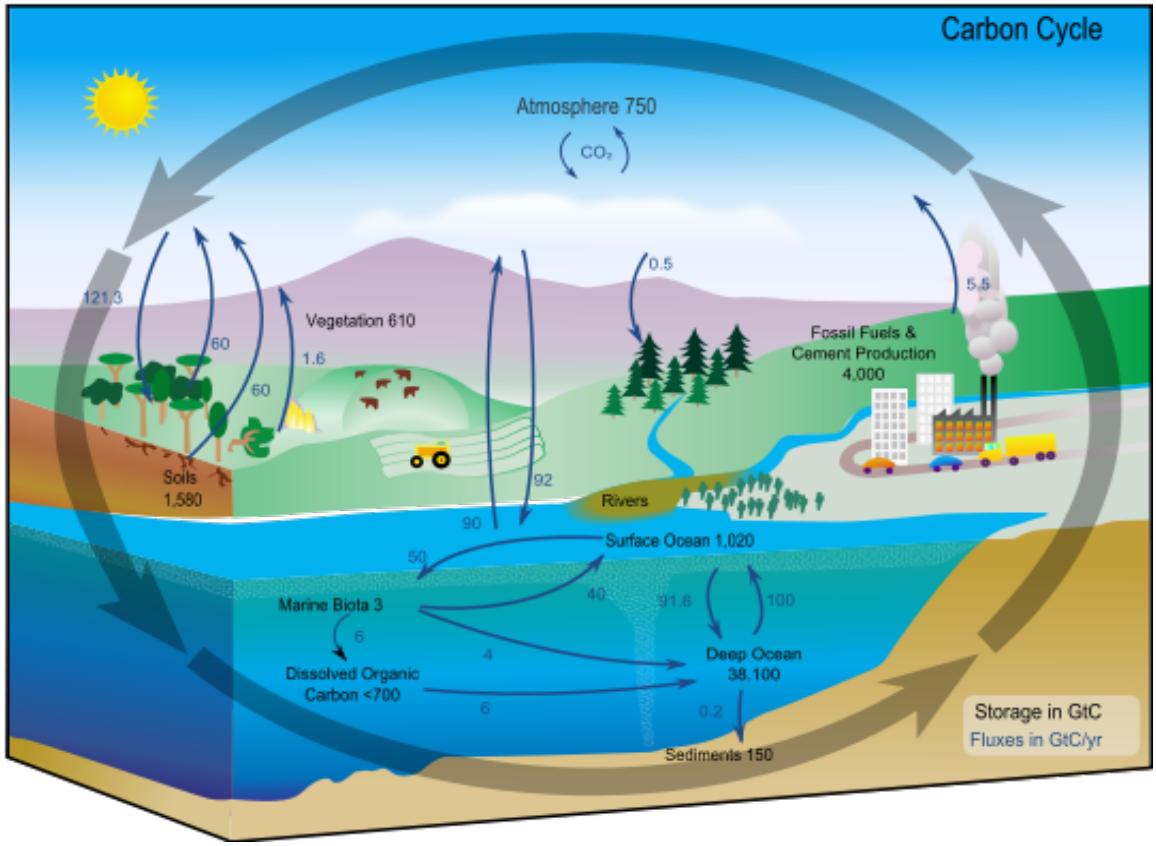
Name _____

The Carbon Cycle

The carbon cycle exchanges carbon among the biosphere, lithosphere, geosphere, hydrosphere, and atmosphere of the Earth. It is one of the most important cycles of the Earth and allows for carbon to be recycled and reused by all living things.

Over billions of years, the carbon cycle seems to maintain a balance between the atmosphere and the other four sinks. This balance has kept Earth's temperature relatively stable and capable of supporting life, unlike any other planet in our solar system. But the ways humans use carbon has moved carbon from a few sinks into the atmosphere. This is changing the balance between sinks and impacting Earth's temperature.

Visual Model of the Carbon Cycle



The black numbers show how much carbon is stored in different sinks, in billions of tons ("GtC" stands for gigatons of carbon).