NAME	**DATE**	**SUBJECT** SOCIAL STUDIES
LESSON #T3.JAM.8A	**GRADE** 4-5	**SCHEMA** CONNECTION
TITLE SYSTEMS SCIENCE		**TIME NEEDED** 30 MINUTES

DESCRIPTION Scientists believe that at one time there were between 30 and 60 million bison roaming the Great Plains. But what does that have to do with us today? *Everything*.

LESSON FOCUS & GOALS The focus of this lesson is to explore the many ways the Northern Plains' ecosystem is interconnected, linked by infinite and invisible patterns yet embedded with many variables. The goal of this lesson is to explore how systems science is a tool we could use to gauge our biological, social, economic and legal connections.

MATERIALS NEEDED

Print enough copies of this packet so each student has (1) role to play T3.8A. Note, there are (4) roles/ packet; if a class has 20 students, print (5) copies. For extensions 8B-G, print 1/student. Pencils.

VOCABULARY

system combination of things forming a unitary whole

HOOK POST OR READ ALOUD

Imagine something that's been knitted, for example, a sweater or mittens. Imagine it has multiple colors. How many different strands of wool, cotton, or silk were needed to weave "many threads," into one thing? Now imagine the same number of strands tied up in one big knot. Compare and contrast the concept of "pattern" with the idea of "chaos."

DIRECTIONS

Divide your class into groups of 4. For each group, print and deliver enough copies of this packet, giving one role/position to each student/group. **2)** Working in small groups, give individuals 10 minutes to read, annotate and complete prompts at the bottom of each page. **3)** Gathering as a class, take 10 minutes to work through as many GUIDING QUESTIONS as possible. **4)** Return to small groups and give students 10 minutes to collaborate on the EXIT TICKET found on the following page. **With any JAM, students are tasked with diagnosing the embedded conflict. The purpose of taking a role, therefore, isn't to empathize too deeply, just enough to rationalize with the assigned viewpoint.*

TEACHER NOTES

, Each JAM package is structured identically, 16 pages, including five (5) extensions, B-G to deepen comprehension and expand writing skills.

T3.JAM.8A **GUIDING QUESTIONS** CLASS DISCUSSION

1. Explain the water cycle in terms of "systems thinking." What's this system's purpose?
2. Explain the interdependent nature of the following two systems: solar system and hydrologic (water) cycle [atmospheric systems].
3. Explain the interdependent nature of the following three systems: hydrologic cycle, botony (study of plants), and wildlife biology (study of wild animals). How do humans connect to these systems?
4. Infer economic opportunities created by the ecosystem. What are the consequences(s) of over-hunting bison? Are humans more dependent on the ecosystem or economic systems?
5. What is the wrinkle, named or unnamed, that does the most damage in this JAM?

T3.JAM.8B **FROM CONFUSION TO CLARITY** PARTNER/INDIVIDUAL

This written re-tell incorporates **1) retrieval practice** and **2) complex syntax**

T3.JAM.8C **STRUCTURED JOURNAL** INDIVIDUAL WORK

This exercise uses **meta-cognition** to help students identify what they're thinking. Gaps in comprehension related to the JAM will reveal themselves; prepare to guide/clarify.

T3.JAM.8D **FROM CLARITY TO COMPLEXITY** PARTNER/INDIVIDUAL

This graphic organizer will help students transfer acquired knowledge from long-term memory back into working memory by **1) retrieval practice 2) elaborating** ideas & details, **3) analyzing** acquired knowledge by comparing & contrasting viewpoints

T3.JAM.8E **BECAUSE, BUT, SO** INDIVIDUAL WORK

Three sentence stems invite students to **1) elaborate** details & ideas, **2)** grapple with **complex syntax, 3)** manage **sequence,** flow & logic through conjunctions

T3.JAM.8F **CIRCLING THE TRUTH** GROUP WORK

This graphic organizer asks students to **interleave** schema, themes & details as they synthesize information into an elaborate re-tell. Great prep work for summary essay.

T3.JAM.8G **LISTEN** CLASS DISCUSSION

Students complete three sentence stems to prepare for class-wide debrief.

PUTTING SCIENCE **INTO THE** SOCIAL **SCIENCES**

Science isn't just knowledge, it's a *process*. The scientific method is a step-by-step process that humans use to study phenomena. For our purposes, we'll use a 7-step process to run a JAM from start to finish. Use this template to help you organize a JAM.

BEFORE A JAM

1. **OBSERVATION** Engage with HOOK
2. **QUESTION** What do you find intriguing about this HOOK? _____
   _____
   _____
   _____
   _____
3. **HYPOTHESIS** Based on the HOOK we predict this JAM is going to address
   _____
   _____
   _____.

DURING A JAM

4. **EXPERIMENT** Divide your class into groups of four (4) students. If there are more than 4/group, that's fine! Some students can share a role. Next, run the JAM! Note, half-way through the JAM, re-convene small groups into one large group for a few minutes to answer GUIDING QUESTIONS found on next page.

5. **ANALYZE DATA** Organize data by using extensions B-F.

AFTER A JAM

6. **SHARE RESULTS** List the embedded conflict(s) here _____
   _____. What could historical figures have done to prevent injustice, violence & instability?
   _____
7. **NOTES** To prepare for the next JAM, list what students/players could do to maximize time, trust & creativity
   _____.

HELPFUL HINTS

Conflict is inevitable, yet humans have the capacity to choose how they engage. In that sense, managing conflict is an artform we could strive to master. JAMs are "task conflicts" based on historical records that position students to practice conflict by wrestling with multiple viewpoints in dynamic situations. The goal is to practice feeling uncomfortable so as to create a habit of invoking **metacognition**, thinking about what we're feeling and thinking, before engaging in conflict. If so, we might be mor apt to think before we speak, analyze seemingly opposite viewpoints, and find common ground. This includes identifying affect from cognition, keeping competing thoughts top of mind, *and* sequencing events into one timeline.

Rooted in rigor, JAMs aren't easy. Competing data sets are discovered through skilled reading, healthy dialogue, and **phenomena**, occurrences or circumstances observed in real time. Taken together, students in a JAM are creating a living model of the past! At that rate, they're facing a golden opportunity to practice the scientific method! See: **PUTTING** SCIENCE **INTO THE** SOCIAL **SCIENCES.** This includes following a step-by-step process whereby they're thinking and behaving like scientists as they record, organize and analyze all data sets.

Anticipate confusion but be prepared for your students to grow and shine as they adapt and outwit history through this new learning strategy. These one-liners might help steady 'em.

- *You are not the center of the universe.*
- *No person, no role, has all the answers; each role is merely one piece of the puzzle.*
- *If each role only presents a sliver of the world, what potential problem(s) will your group face when trying to make sense of reality?*
- *What's the wrinkle? What's the embedded conflict? What's the JAM?*
- *Can you name the "elephant in the room" without losing anyone's confidence?*
- *Emotions are neither good nor bad; they're merely signposts that offer guidance as we try to navigate learning.*
- *The trick is learning how to get out of a JAM without creating a bigger mess.*

Name _____ **L 750**

1. ***Who am I?***

I am a chemical compound formed when two hydrogen atoms bond to one oxygen atom. I cover 71% percent of the Earth's surface, and I can exist as a solid, liquid, or vapor. Everyone needs me, and loves me, unless I overwhelm them. Scientists say that I am older than the sun, suggesting planets depend on me, too. *Who am I?*

In the atmosphere, where I exist as vapor, I draw moisture from the ocean, increasing my weight and volume until I fall to the Earth either as solid crystals or liquid. If I don't return to the ocean immediately, it's because I fell in colder, high places, such as mountains. There, I stick to other crystals until the sun warms me enough to turn back into liquid and I descend creeks and streams and rivers—back into the ocean, starting the cycle all over again. Unless, I seep into the ground, quietly nourishing the roots of trees and plants. That, or I could trickle into underground aquifers, cool lakes that are always dark and calm. If not, people might catch me so they can drink me, irrigate their crops, or fill their reservoirs. Yet if the temperature rises above a certain threshold, I simply vanish.

What's your role: _____

Where? _____

How? What happens first? _____

What happens next? _____

Or else this happens _____

Or this could happen _____

Why am I an important part of the systems described here? _____

_____

_____

Name _____ **L 850**

2. Who am I?

I begin my journey in the darkness, drawing in nutrients found in the soil. When I have the correct ratio of minerals, water, and air, I make my break and head for the light. As soon as I feel the sun's energy, I start stretching, pushing myself to reach up as fast as my roots dig down. *Why?* The sun kicks off a chemical reaction inside of me, called **photosynthesis**, whereby I transform the sun's energy into **glucose** and oxygen so that I might accomplish three tasks:

FIRST, humans and animals need glucose, or sugar, for energy. Those who eat me, but not meat, are called herbivores, or vegetarians. Some people think only small animals like rabbits and llamas are herbivores but that's *not* true! Some of the worlds' largest mammals, such as bison, or North American buffalo, rely on me as the main food source. **SECOND**, the more animals and humans consume me, the deeper my roots grow in search for more minerals so that I might emerge again the next year, stronger and more nutritious. This, in turn, prevents erosion because my roots fix the soil to the Earth, protecting the land from severe weather, versus everything blowing away. **THIRD**, in case you're wondering if I need anything else to survive, besides water, minerals, and sunlight, you should know that I thrive by absorbing a chemical compound from the atmosphere called carbon dioxide. This chemical compound is so toxic that if it were to become too abundant, it would overwhelm the entire system. Whereas, provided a healthy balance, I'm able to absorb it and convert it into oxygen.

Name your role:

How? _____

Under what circumstances does this happen? _____

Next, this happens _____

Then this happens _____

Why am I an important part of the systems described here? _____

_____

Name _____ **L850**

Who am I?

I am a very large mammal with horns, native to North America. Although very few of us remain, relatively speaking, scientists believe that at one time there were between 30 million and 60 million of us roaming the Great Plains, which stretch between the Rocky Mountains and the Mississippi River.

Like many other mammals, I have four legs and a tail, but I also have hooves and a fantastic coat comprised of long, dark, thick hair. I tend to move slowly, but I'm surprisingly agile, and can run up to 35 miles per hour and jump as high as 6 feet! While I'm a fierce athlete, I'm also a devoted parent. For instance, if my baby is threatened, I am always ready to defend it. Similarly, I never turn away from blowing snow or winds, instead I walk into the eye of a storm so I don't lose my way.

Even though I am a vegetarian—getting 93% of my diet from plants and native grasses—I can weigh between 700 and 2,000 pounds. I spend about 9 to 11 hours a day grazing, eating around 24 pounds of food. With all that grazing, you can imagine how much dung I produce! The best part is that my waste is rich in nutrients like nitrogen, phosphorus, calcium, sulfur, and magnesium. That means as I graze, usually in large herds, my hooves cultivate the soil, mixing dung into the ground as fertilizer, enriching the roots of the plants we will feed on the following year.

Yet I am not the only animal that relies on native plants and grasses. All creatures in our ecosystem—whether herbivores like elk and deer, or carnivores like bears and wolves, plus fish, birds, and insects—depend on the same life cycle.

Name your role _____

Where? _____

Who depends on this role? _____

Why am I an important part of the systems described here? _____

_____

_____.

Name _____ **L 950**

3. Who am I?

We've lived in North America since time immemorial, long before recorded history. Some say for over 10,000 years. Some say longer. Our history guides us, reminding us of our identity, values, and commitment to the future. Before books, we passed our stories by carving petroglyphs into rocks, or illustrating pictographs on leather.

One crucial aspect of our existence is our relationship with nature, particularly with bison. Bison provide us with everything we need to survive. When we hunt bison, we obtain food, while bison hides offer warmth and soft bedding. But that's just the beginning! We collect bison dung and burn it as fuel for our campfires. We use their tails as fly swatters, and their stomachs as water containers. We boil their hooves into glue, and their brains into surrey to tan their hides so we can make clothing, shoes, and our lodges.

Just the same, we revere bison, who are a living symbol of the creator's desire to protect and sustain all living creatures on Earth. In this way, bison embody our spirituality, or religion. Therefore, they allow us to express gratitude for the circle of life.

Recently, at least in the grand scheme of things, men with hair on their faces like animals journeyed into our land, hunting animals for their furs—not for survival, but for trade. Not just a few furs, but many. Many of us have been enticed to supply these furs in exchange for clever trade items these strangers brought with them, such as pots, cooking utensils, and beads. *But some of us worry this relationship is damaging the circle.*

Name your role _____

Where? _____

Why is "place" a critical aspect of this role's life? _____

_____

How does our traditional way of life offer valuable lessons to science? _____

_____

_____

_____

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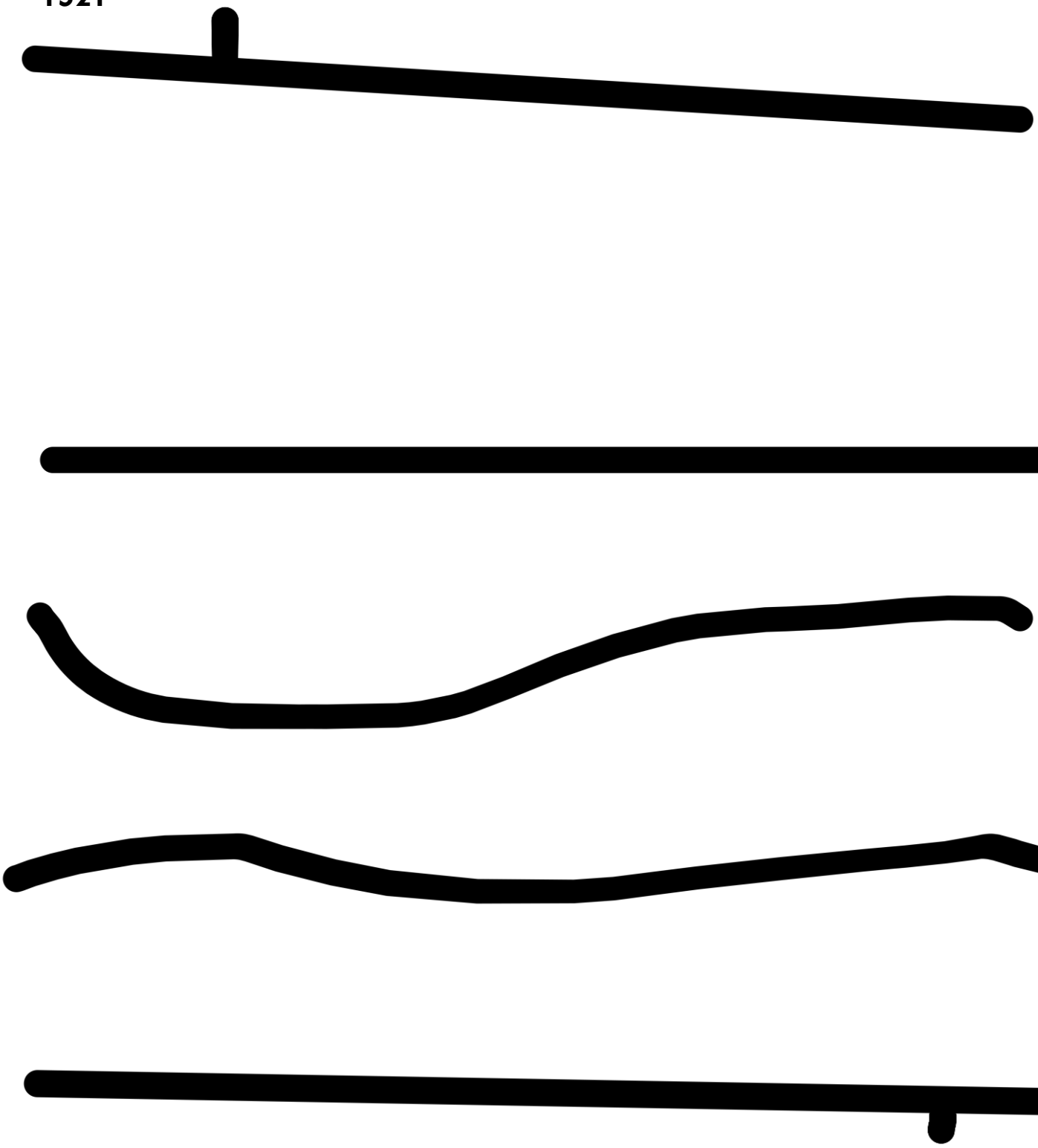
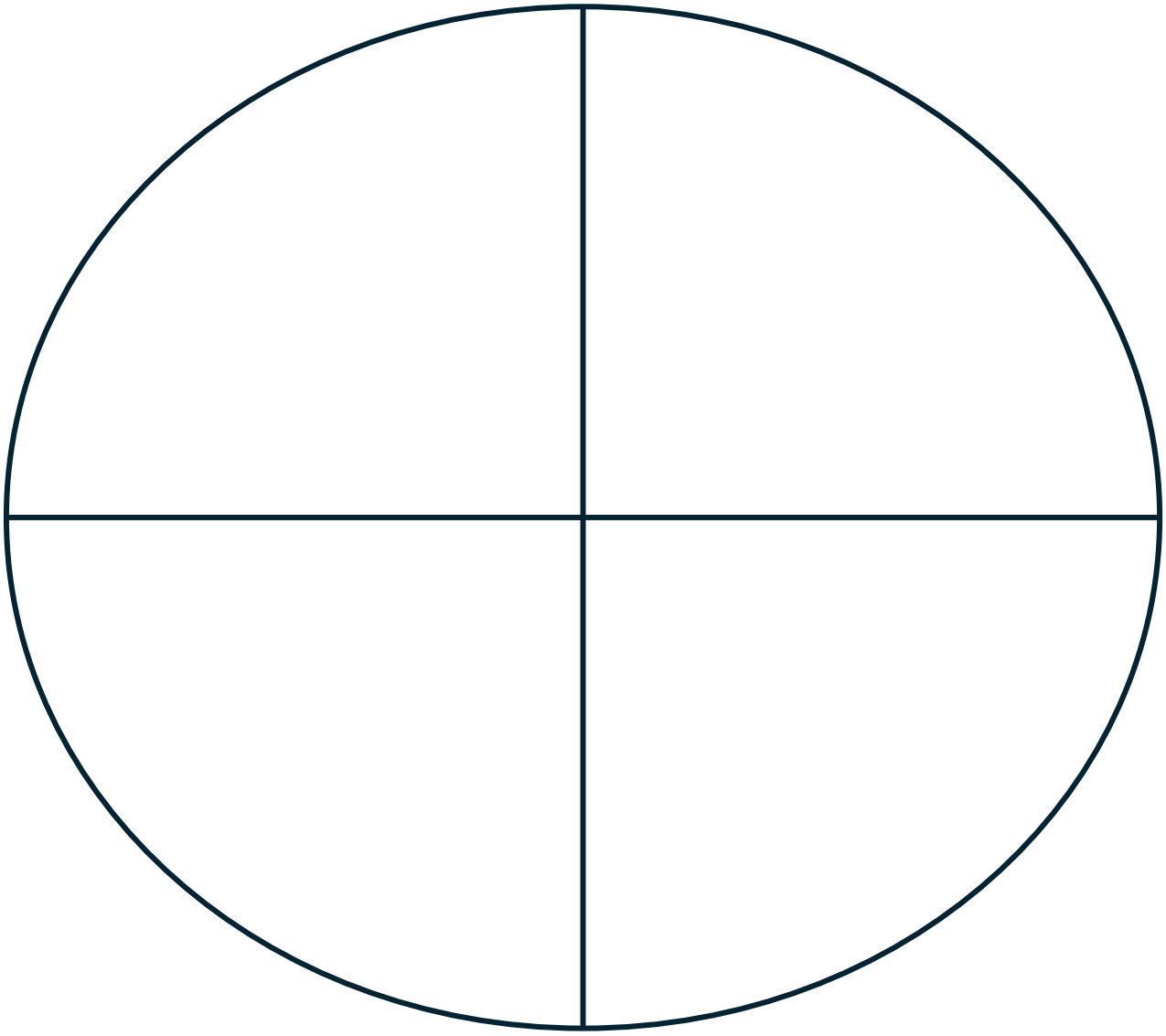


Names _____, _____, _____, _____

EXIT TICKET WHAT'S THE JAM?

The JAM refers to the thread that connects the (4) viewpoints, the underlying issue few people say aloud. It's the sticky bit; the embedded conflict. *Delicate, nuanced & complex*.

DIRECTIONS 1) Label each quadrant: one role/quadrant. **2)** Detail each quadrant with key events, players, including cause and effect—use your notes! **3)** Gather as a class to answer GUIDING QUESTIONS. **4)** Return to small groups to discuss/identify the wrinkle, aka, the "embedded conflict," aka the JAM. **5)** Name the JAM below.



The root cause of the JAM is _____.

NAME	**DATE**	**SUBJECT** SOCIAL STUDIES
LESSON #T3.JAM.8B	**GRADE** 4-5	**SCHEMA** CONNECTION
EXTENSION FROM CONFUSION TO CLARITY		

DIRECTIONS FILL IN THE BLANKS

This story is simple. It's an ancient story that reminds us of how we're connected to each other when we balance giving and taking. However, if we don't understand the basic elements that define our role on Earth, we're unlike to find _____. On second thought, this story is simple *and complex*.

Before people, before animals, before plants, there was _____. At its core, water is a bond between two elements, _____ and _____. Long ago, it covered most of Earth. Today it covers about ____% of the Earth's surface. It falls from the _____, either into the ocean or on _____ tops as _____. Wherever it melts, it makes its way through _____ and _____, but eventually runs back to the _____,starting the cycle anew! Unless people catch me, drink me, _____ their crops, or save me for later in reservoirs. Unless somewhere along the way I _____ under the hot ____.

Add seeds to this story, then something extraordinary happens! Whereby minerals found in the Earth's soil combine with water and sunlight, kicking off a chemical reaction called _____. *The process is nothing short of magical!* The result is _____ and _____. Oxygen provides fresh air; while glucose, or sugar, feeds people and animals. *The animals!* They love eating plants, plus, the more they eat, the deeper plants' roots descend in search of nutrients, helping them grow stronger, healthier and more resilient, and therefore capable of preventing _____. Additionally, large animals also help maintain this cycle since their food waste, dung, is nutrient-rich fertilizer that they "turn" or trample back into the soil. Meanwhile, forests reinvigorate the atmosphere by absorbing _____, a chemical compound that would otherwise poison humans.

Later, people arrived. They drank, ate, bathed, and generally survived, often grateful for the mystery and the science that sustains a livable planet. For Native nations, the only people living in North America until _____, they recognized the interconnected nature of _____. Along the way, the studied the _____ that explains nature, and celebrated the _____ of its origins.

NAME	**DATE**	**SUBJECT** SOCIAL STUDIES
LESSON #T3.JAM.8C	**GRADE** 4-5	**SCHEMA** CONNECTION
EXTENSION STRUCTURED JOURNALING		

1. **What are the most important ideas in this JAM?** _____

_____

_____

_____

_____

_____

2. **This is what I don't completely understand …**_____

_____

_____

_____

3. **This JAM connects to my reality in that …**_____

_____

_____

_____

4. **I wonder…** _____

_____

_____

_____

5. **I also wonder…** _____

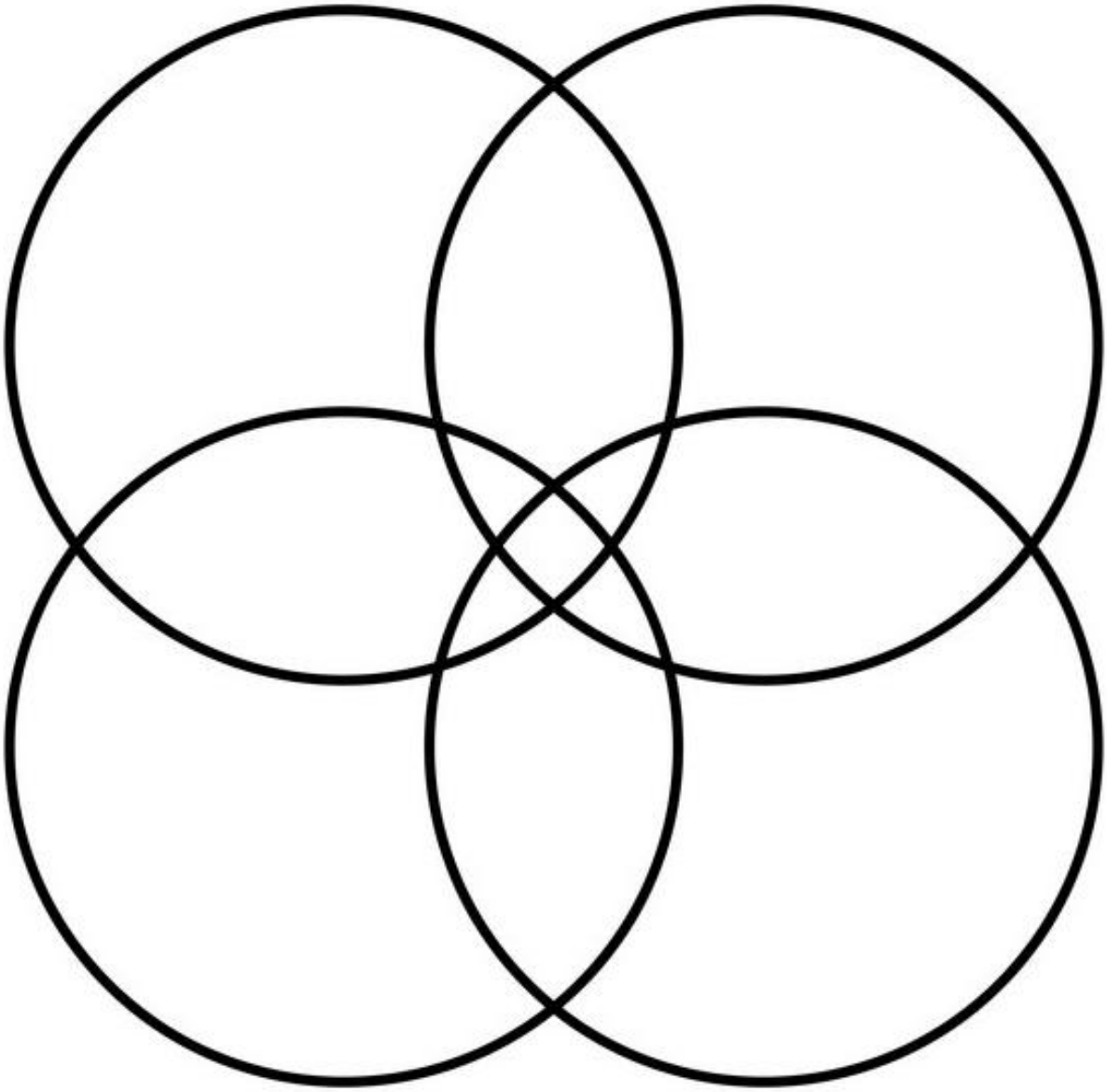
_____

_____

_____

NAME	DATE	SUBJECT SOCIAL STUDIES
LESSON #T3.JAM.8D	GRADE 4-5	SCHEMA CONNECTION
EXTENSION FROM CLARITY TO COMPLEXITY		

DIRECTIONS *How is this graphic organizer different from the first one?* **1)** In the margin of this 4-Way Venn Diagram, label each circle with the JAM's (4) viewpoints. **2)** Consider how some viewpoints' characteristics overlap, or share intentions, goals or actions. **3)** In the shapes *don't* overlap with others, list what makes that viewpoint unique from all others.



NAME	**DATE**	**SUBJECT** SOCIAL STUDIES
LESSON #T3.JAM.8E	**GRADE** 4-5	**SCHEMA** CONNECTION
ASSESSMENT BECAUSE, BUT, SO		

DIRECTIONS Complete the following sentence stems in a way that demonstrates as much perspective as you're able, putting history into its full context

1. When European explorers emerged on the Great Plains they may have inadvertently disrupted thousands of years ecological balance on the Great Plains **because** _____

   _____

   _____

   _____.

2. When European explorers emerged on the Great Plains they may have inadvertently disrupted thousands of years ecological balance on the Great Plains **but** _____

   _____

   _____

   _____.

3. When European explorers emerged on the Great Plains they may have inadvertently disrupted thousands of years ecological balance on the Great Plains **so** _____

   _____

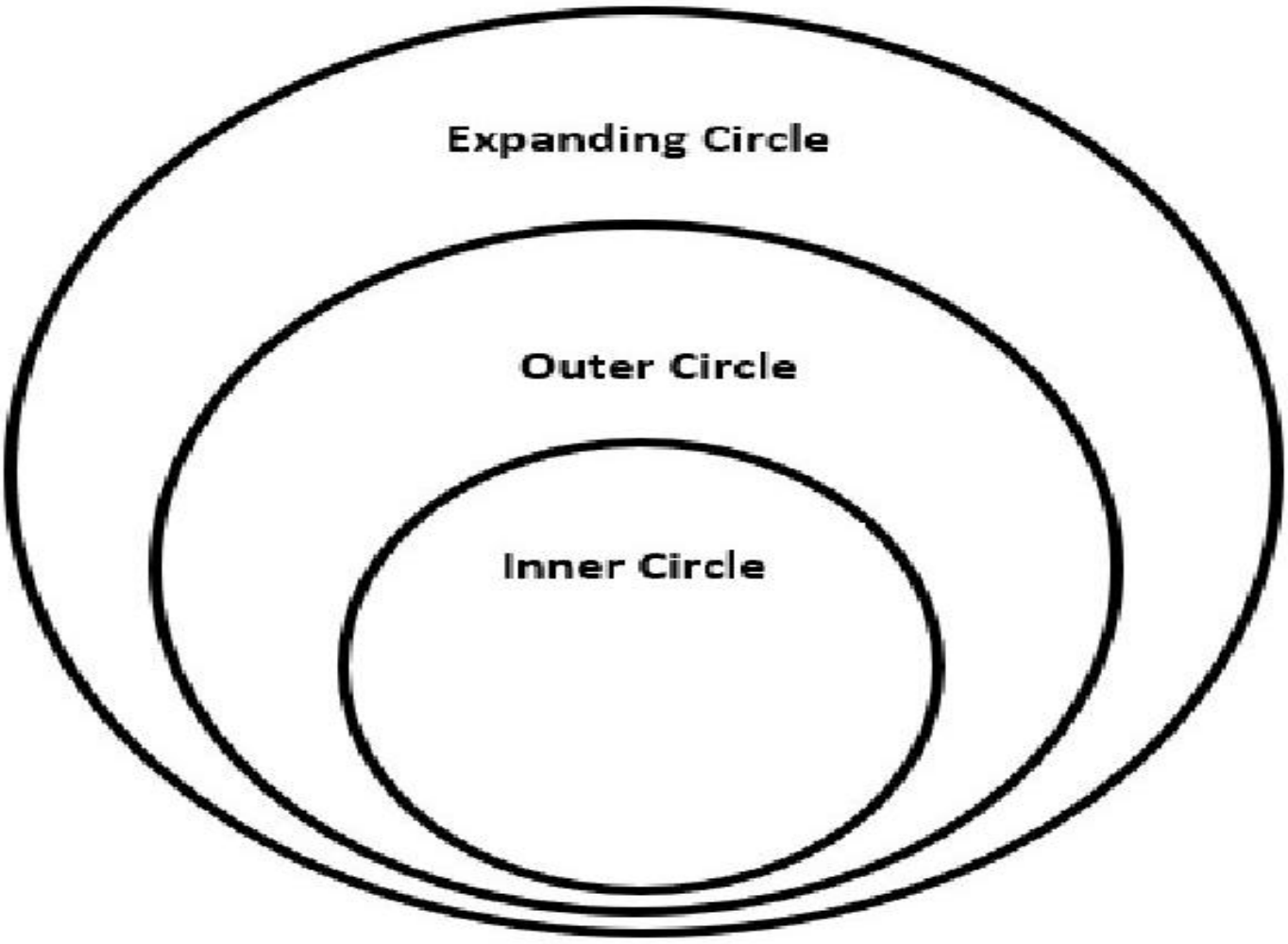
   _____

   _____

NAME	**DATE**	**SUBJECT** SOCIAL STUDIES
LESSON #T3.JAM.8F	**GRADE** 4-5	**SCHEMA** CONNECTION
EXTENSION CIRCLING THE TRUTH		

DIRECTIONS 1) Select ONE theme (perhaps the embedded conflict you named at the end of the JAM) that you believe unites all (4) viewpoints. Write it down in the *Inner Circle*. **2)** Choose any (3) of the "5 Strands" of Social Studies—***geography, history, government, culture, economics***—that you think demonstrate *how and why* different roles chose the paths or strategies they did. Write those words in the *Outer Circle*. **3)** Use "Retrieval Practice" to list details that support the three strands you listed in the outer circle. **BONUS:** Use this graphic organizer to write a one-paragraph summary essay.

POTENTIAL THEMES (CHOOSE ONE): POWER, MONEY, DEMOCRACY, AUTHORITY, MONEY, BALANCE, KNOWLEDGE,



NAME	**DATE**	**SUBJECT** SOCIAL STUDIES
LESSON #T3.JAM.8G	**GRADE** 4-5	**SCHEMA** GAME THEORY
EXTENSION CLASS-WIDE DEBRIEF		

DID YOU KNOW? Oral storytelling is an integral component of Native nations culture that offers neurological and cognitive benefits. For example, storytelling supports resiliency by promoting early literacy through social cognition, language processing, and memory storage. This is evidenced by the fact that Native nation stories have been scientifically validated as reliable records of historical events going back thousands of years. In summary: *active listening is an unparalleled learning strategy*.

DIRECTIONS Complete these sentence stems to summarize your thoughts (5-7 minutes). Next, bring these pearls of wisdom to share in a class-wide debrief so you and your classmates can practice speaking & listening.

1. One historical event that happened during this JAM that the world needs to spend more time thinking about is _____
   _____
   _____
   _____.

2. One behavioral pattern that I noticed during the historical events of this JAM that could support sustainability in the world today is _____
   _____
   _____
   _____.

3. One thing my small group did well in this JAM, a behavioral pattern that I believe could make the world safer or more sustainable is _____
   _____
   _____
   _____.