

This book belongs to:



STUDENT WORKBOOK

LESSON 1: PRE-READING

Use your copy of *Terra Tempo: Ice Age Cataclysm!* to fill in the answers to the following. Record your answers on the Workbook cover in the blank spaces provided.

- 1. What is the full title of this book?
- 2. What are the three main characters' names? (Flip through your book to find out.)
- 3. What type of cataclysm, or disaster, is this book about?
- 4. Describe below what you think will happen in this book.

KWL CHART

WHAT DO I KNOW ABOUT THE ICE AGE?	I WANT	WHAT HAVE I LEARNED ABOUT THE ICE AGE?

LESSON 2: CHAPTER 1 – LOCKED DESK

CHAPTER 1 VOCABULARY

Ranging- _____

Mancala- a type of board game

Age- geologic period

Council Crest- _____

Reverberator- _____

Portal- an entrance or doorway

Compass- direction finder

Prehistoric- _____

Paleontologist- a person who studies ancient life. They examine fossils for clues about how life has changed throughout the ages.

Pleistocene- a period in Earth’s history about 2.5 million years ago until 10,000 years ago. This is the time of great ice ages.

CHAPTER 1 QUESTIONS

1. Whose house are the kids in when they discover the map and journal?

2. What does the journal say needs to happen in order to activate the portal?

3. Ari says his parents found a mammoth skeleton. What do you think they do for a living?

4. What do you think some key differences will be between modern times and the age the kids have traveled to? Give at least three examples.

1.

2.

3.

SOME OF THESE EXISTED DURING THE ICE AGE, BUT ALL EXIST TODAY. LABEL THE FOLLOWING ON YOUR MAP:

Portland

Seattle

Missoula

Cascade Mountains

Rocky Mountains

Pacific Ocean

Spokane

COLOR OR OUTLINE AND LABEL:

Washington

Oregon

Idaho

Montana

ALSO LABEL YOUR MAP "MISSOULA FLOODS MAP"

LESSON 3: CHAPTER 2 – THUNDERBIRD

CHAPTER 2 VOCABULARY

Invocation- calling upon a spirit or god for help

Mythic- _____

Carnivore- meat eater

Flow rate- _____

Climate- the general weather conditions of a region, such as temperature

Ice Dam- when ice acts as a dam, blocking water and causing it to pool

Scoured-

CHAPTER 2 QUESTIONS

1. Describe how the kids escape the short-faced bear.

2. The kids are in the same geographic location as Council Crest, but over 15,000 years earlier. What differences do you recognize?

Were your predictions from Chapter 1 correct?

3. What does Ari say is happening that is causing all the water?

4. Summarize some effects of the climate change at the end of the ice age.

5. The kids are the blinking red dot on the map. What is the name of the blinking blue dot that they are heading towards?

LESSON 11: GRAPHIC NOVEL PART 2

Brainstorm descriptions and answer the following:

Character name(s):

Two words describing your main character(s):

Three words describing the setting of your story:

Four words describing your important event or climax:

Five words describing the importance of this event:

LESSON 12: GRAPHIC NOVEL PART 3

Brainstorm titles for your novel in the space provided:

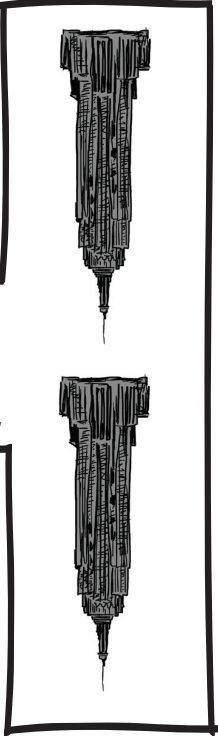
THE MISSOULA FLOODS:
AKA THE BREITZ FLOODS

A MASSIVE ICE DAM
BLOCKS THE
RIVER

WATER BACKS UP
BEHIND THE DAM
CREATING A

THE ICE DAM
LETTING
ALL THE LAKE
WATER OUT

THE WATER
FLOWED ALL THE
WAY FROM IDAHO
TO THE

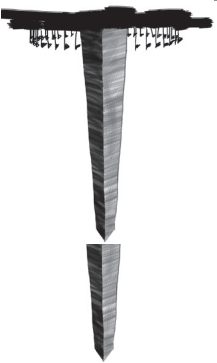


The Ice Dam was two
times as high as the
Empire State Building.

The water that formed
the lake would be more
than four times larger
than Lake Erie.



When the dam broke, it
let loose a wave of water
1 1/2 times the height
of the Washington
Monument and moving
350 times faster than
the Mississippi River.



The water traveled
more than twice
the distance from
Washington D.C. to
New York City.



LESSON 4: CHAPTER 3 – THE GAP

CHAPTER 3 VOCABULARY

Orbit- the path of a celestial body (such as asteroids, moons, planets, stars) or an artificial satellite as it revolves around another body

Ellipse- a shape like an oval or a cross section of a cone

Elliptical- having a shape like an ellipse

Sum- the total when you add everything up

Tilt- to lean, slope or slant

Zodiac- an imaginary belt of the heavens tracking the apparent paths of the sun, moon, and principal planets. It contains twelve constellations and hence twelve divisions called signs of the zodiac.

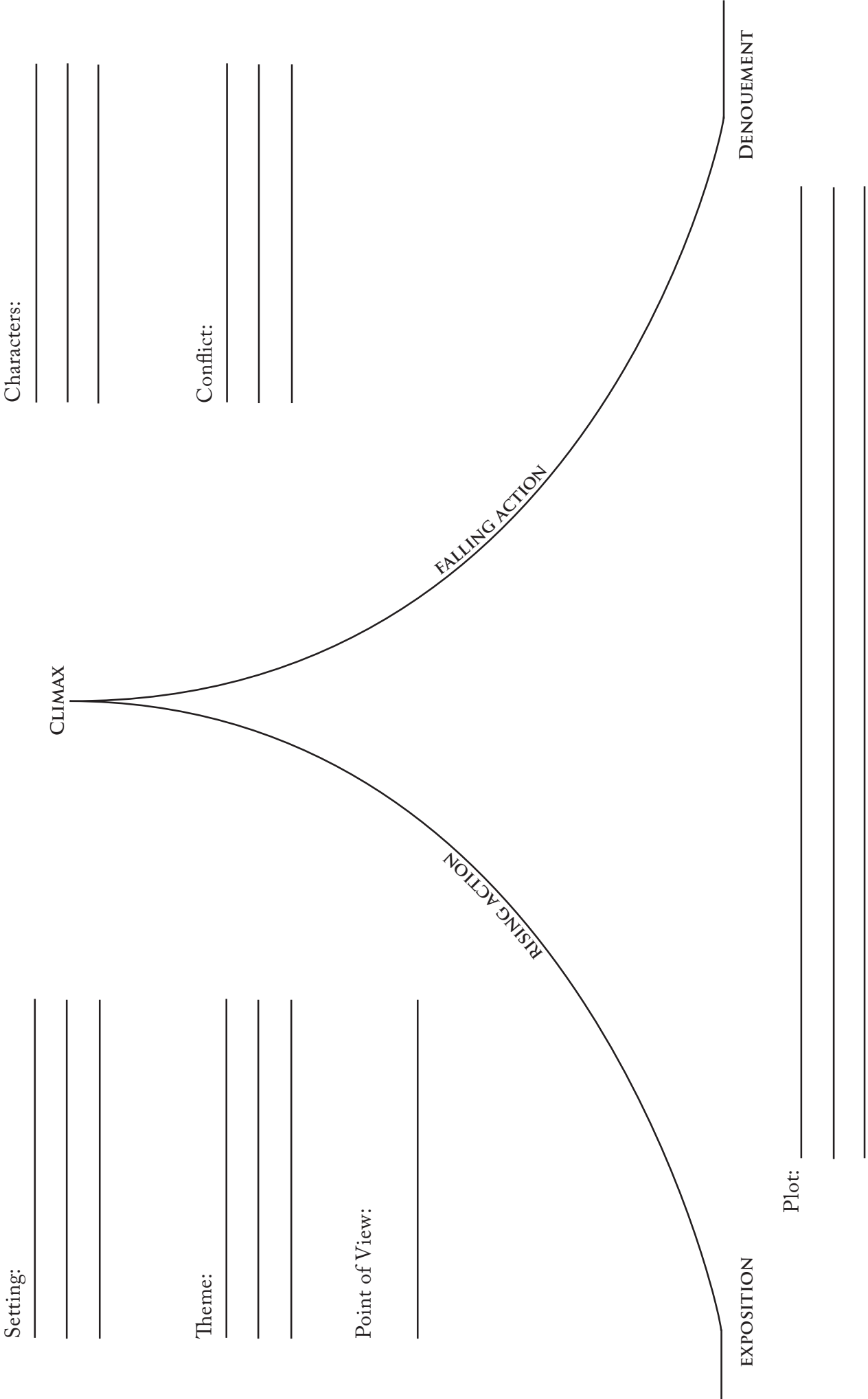
Celestial Sphere- The stars can be imagined to be points of light on a sphere that rotates about the earth. Projecting the Earth’s poles and equator out onto this imaginary sphere provides a framework for celestial measurement.

Ecliptic- the apparent path of the sun’s motion on the celestial sphere as seen from Earth.
Explanation: If you watch the sun set over the course of the year, you will notice that after the vernal equinox (usually March 21) the sun will set further and further north until the summer solstice usually June 21.) After the summer solstice, the sunset will move further south each day until the autumnal equinox (September 21) will set in the same location as it did during the vernal equinox. After the autumnal equinox the sun will set further and further south until the winter solstice when it sets the furthest south that it will all year. The sun then begins its journey north once again.

Equinox- either of two points on the planet at which the ecliptic intersects the celestial equator and when the length of day and night are approximately equal; the vernal equinox or the autumnal equinox.



THE ART OF STORYTELLING



LESSON 10: GRAPHIC NOVEL PART 1

COMPLETE THE INQUIRY

Retrieve the frozen cup of water from the previous lesson and complete the inquiry.
Observation: What has happened to the frozen water in relation to the line you drew yesterday?

Results: When the water froze it _____

Draw Conclusions: When water freezes...

Compare your results with the rest of the class's results. Has your conclusion been supported by others?

GRAPHIC NOVEL VOCABULARY

Setting- where and when the story happens

Characters- the players (major and minor) taking part in the action of the story

Climax- the most decisive moment or major turning point in the story

Plot- key events

Exposition- background needed to understand the story

Rising Action- a related series of incidents that build toward the climax

Falling Action- the climax has finished and the story is heading towards a conclusion

Denouement- the final resolution or end result of a dramatic event or narrative; the outcome

Theme- the subject or main idea of the story

Point of View- the position of the narrator in relation to the story

CHAPTER 3 QUESTIONS

1. Caleb is trained in survival skills. What does he say they need to accomplish? Explain why each is important to surviving in the wild.

1.

2.


3.

4.

2. How did Uncle Al first get the map?

3. How does the map work, according to Uncle Al's journal entry?

4. The characters learn that the stars look different in the Ice Age because Earth has gone through changes in position, tilt, and orbit. Read the summary of the three planetary cycles and draw an illustration to represent the meaning. Then describe how these cycle changes affect the climate of Earth:

PLANETARY CYCLE	ILLUSTRATION	HOW WOULD THIS EFFECT EARTH'S CLIMATE & SEASONS?
Cycle 1: The orbit of Earth around the sun cycles from a circle to an ellipse about every 100,000 years. This changes the distance from Earth to the sun.		
Cycle 2: The tilt of the Earth's axis cycles from 20.4 degrees to 26.2 degrees every 42,000 years. The greater the tilt, the more variation in seasons		
Cycle 3: Earth's axis wobbles like a top as it spins, changing the location of the pole, stars, and the view of the Zodiac constellations. This helps chart time and location. If the Earth had no wobble, the tilt of the axis would straghten to 0 degrees (think of Cycle 2).		

5. What was the theory that Milutin Milankovitch put together?

EARTH TOP ACTIVITY

This activity will demonstrate the third planetary cycle, our current cycle, known as the precession of the equinox.

- 1. Cut out the Earth top pattern (coloring is optional).
- 2. Tape the folds on the pattern together to form a 3D diamond shaped Earth.
- 3. Cut small holes in the North and South Poles.
- 4. Finally, cut out and roll the instruction box and insert it into the holes cut at the poles. This represents Earth’s axis.

Place your Earth Top on the planet Earth in the center of the Zodiac Dial and gently spin. When the top falls over, the zodiac sign(s) it lies on is the constellation visible to Earth at night. The constellation opposite on the dial is obscured behind the sun and will not show up in the night sky for another 6 months! For example, when Capricorn is visible, Cancer is not. Also notice the change in the North axis of the top points. This is comparable to the changing pole star, which occurs due to the Earth’s top-like wobble.

TRY THIS AT HOME!

We keep referring to a top-like wobble. Spinning a quarter can be a good demonstration of what we mean. As the quarter’s spin slows down, it wobbles similarly to the Earth’s wobble as it rotates in space. You can also try spinning a hard boiled egg to demonstrate this wobble.

FREEZING WATER ACTIVITY

- 1. Fill part of a clear or translucent cup with water. When the water settles draw a line around the cup to mark how high the water rises.
- 2. Fill out the Inquiry Questions below.
- 3. Freeze.

Tomorrow: Compare the frozen water level to the liquid level marked with a line. Complete the Inquiry.

INQUIRY

- Question:** What will happen to the water in the cup when it freezes? (Circle your choice)
- a. Nothing will happen
 - b. It will expand higher than the line
 - c. It will shrink below the line.

Hypothesis: Your answer to the above question is your hypothesis, or something you think is true.

When the water freezes_____

Test your hypothesis: Freeze the cup and answer the rest of this inquiry tomorrow.

KOLKS ACTIVITY

Kolk- A kolk is like an underwater tornado that occurs in fast-moving water. It is capable of picking up and moving earth, or blasting huge boulders and rocks apart.

Materials:

- Empty soda liter bottle with cap
- Glitter
- Small rock or pebbles

- 1. Fill the soda bottle ¾ of the way full with water.
- 2. Add in a generous amount of glitter. Be sure it is a color you will be able to see in the water.
- 3. Add the pebbles.
- 4. Flip it upside down so that the cap is facing down and the wider bottom part is up, and let it all settle.
- 5. Shake the bottle in a circular fashion to create whirlpool and underwater twister. You can see the twister better if you hold it up with a light source behind the bottle.
- 6. How this is similar to a kolk (*see uncle Al’s explanation*)? Discuss.

7. Review concept: a kolk is another example of water’s independence of scale.

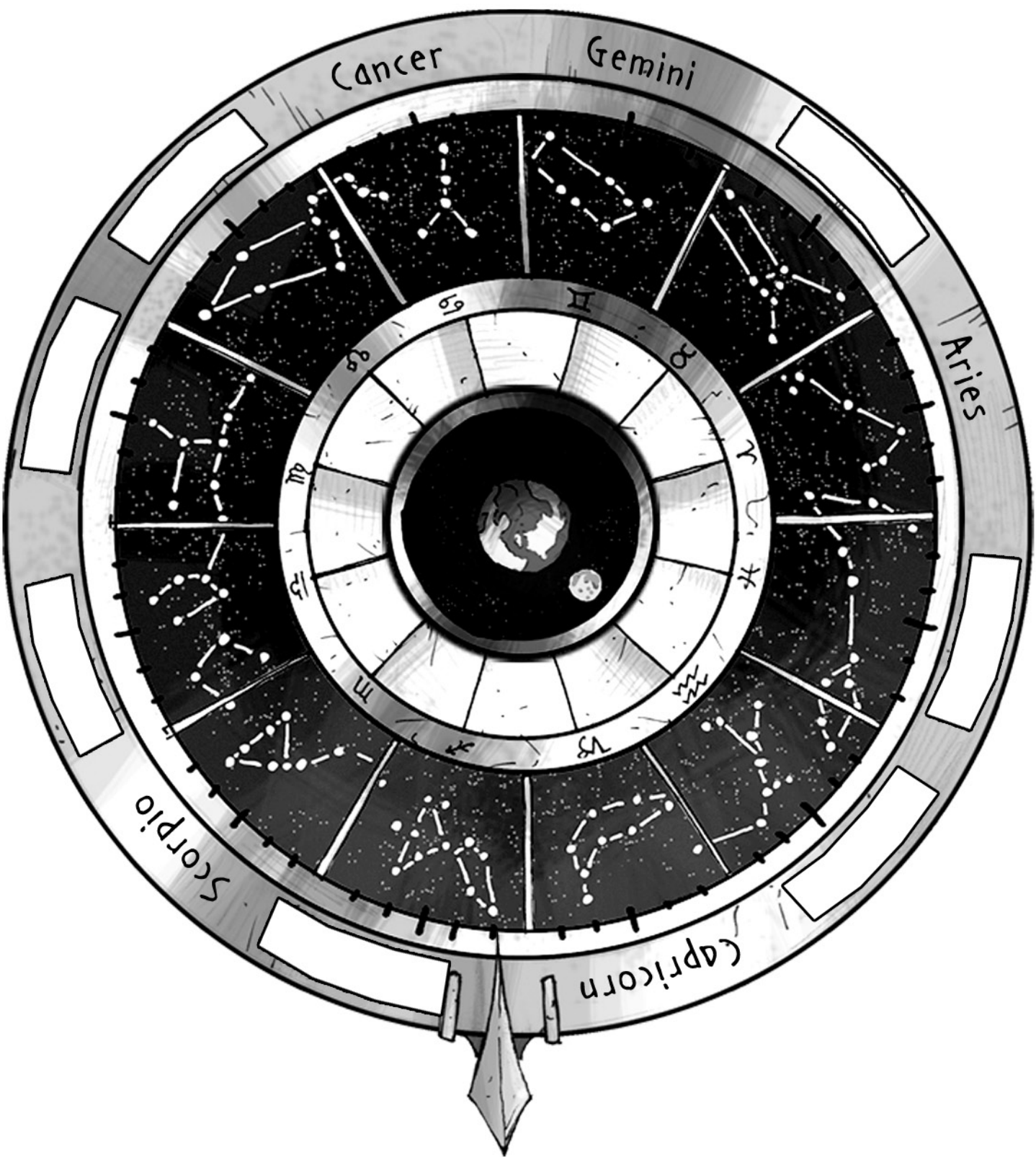
LESSON 9: CHAPTER 8 – PORT OF ORIGIN

USE YOUR MAP TO ANSWER THE FOLLOWING:

- 1. Which direction do Jenna, Caleb, and Ari fly from Portland to the Wallula Gap?
- 2. From the ice dam which direction does Lake Missoula extend?
- 3. When the ice dam breaks, which direction does the flood water travel?

CHAPTER 8 QUESTIONS

- 1. How would you describe Uncle Al's behavior when the kids appear in modern times on Council Crest?
- 2. What do you think Uncle Al is talking about when he says there were greater dangers than saber-toothed cats and giant short-faced bears?
- 3. A theory about why the ice dam broke has to do with water moving through small cracks causing friction. Rub your hands back and forth together to demonstrate friction. Explain how friction could cause the ice dam to break.
- 4. Why do you think Uncle Al doesn't want the kids to talk about their time travel experience, even with their mother?



LESSON 5: CHAPTER 4 – THERE’S SO MUCH WATER

CHAPTER 4 VOCABULARY

Glacial erratic- rocks carried by ice and deposited on material different than the rock. Ice can pick up huge amounts of material such as boulders, some large in size and weighing tons, then move them many miles

CHAPTER 4 QUESTIONS

1. What is the significance, or importance, of the Wallula Gap during the flood?
-
2. What are the three dials called and what do they do?
1.

2.

3.
3. How did the rock rafting on the iceberg get to its current location?
-
-
4. What do you observe about the great waterfalls?
-
-
5. What is the name of the animal that Caleb sees munching on the tree?
-

LABEL ON YOUR MAP

Dry Falls

Willamette Meteorite discovery point

USE YOUR COMPASS AND COMPASS ROSE TO ANSWER THE FOLLOWING:

1. Which direction is the door from your desk?
2. Which direction is the teacher’s desk?
3. Which direction is the clock?
4. To get to the pencil sharpener from your desk, which direction do you need to travel?
5. What direction is the front office from your classroom?
6. If your friend stood facing the board with their back to you, what direction would they be facing?
7. What direction would your friend, the one facing the board, need to travel to get to you?

LABEL YOUR MAP

Label the compass rose on your Ice Age Flood map and align the map with the compass you just made. (Turn the Ice Age map until North on the map’s compass rose is parallel with North on the compass rose you made in class.) Use the compass to determine:

1. Which direction from your desk is Seattle?
2. Which direction is Missoula?

COMPASS BUILDING ACTIVITY

The characters have Caleb's compass to help them determine directions and navigate. You will build your own compass and use it to determine directions and answer questions about location.

Materials: paper clip, magnet, cup, pencil, string

1. First unfold a paper clip so that it is as straight as possible.

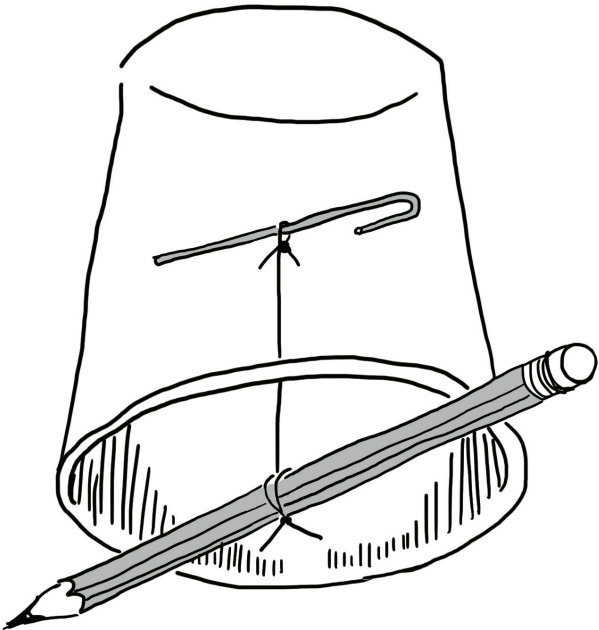
2. Slowly rub the straightened paper clip in the same direction along a strong magnet 30 times. This will magnetize your paper clip.

3. Put the magnet aside and tie a string from the center of a pencil to the center of the paperclip so that it is balanced and hangs evenly.

4. Place the pencil over the rim of a cup and let the paperclip hang in the center.

5. Watch as the paper clip aligns with Earth's North and South magnetic poles (once the paperclip stops swinging).

- To test your compass, rotate the cup and wait for the paper clip to align North/South again.
- If it does not point the same direction after moving the cup, your paper clip may not be magnetized and you need to repeat #2.



6. Once you have successfully built a compass, compare with others to determine with the class which direction is North, South, East, and West.

7. Draw a compass rose to mark North, Northeast, Southeast, South, Southwest, West, and Northwest. (Suggestion: Place a piece of paper under your compass cup and mark North, then South, then East and West, but do not move the paper, only the compass!)

TRANSLATION ACTIVITY

Can you find the meaning of the chants? You may insert some English words into your translation to make complete sentences.

CHANT	WORD	MEANING							
KLATAWA	LALY	TUM TUM	WAKE				SINAMOKST	SUN	

CHANT	KLATAWA		TUM TUM	SHAH	HYAS	CHUCK
WORD	MEANING					
YOUR TRANSLATION						

CHINOOK DICTIONARY

CHINOOK	ENGLISH	CHINOOK	ENGLISH
Aiki	In the future	Lolo	To carry
Alta	Now	Mamook	The act of doing anything
Chako	To become	Mahsie	Thank you
Chuck	Water	Mika	You, yours, thee, thine
Cultus	Worthless	Muck a Muck	Food
Elakha	Sea otter	Nesika	We, our, ours, us
Elan	Aid, help, assistance	Oalie	Berries
Hyas	Many, vast	Polaklie	Night
Ilahce	Land, home	Saghalie	Sky, heaven, celestial, uppermost
Ikpoioe	To shut	Siah	Far off, distant, remote
Kawak	To fly	Sinamokst	Seven
Kimtah	Behind, after, afterwards	Skookum	Strong, powerful, potent
Killapi	To return	Sun	A day, the sun
Klatawa	Travel	Tahmahnawis	A guardian or familiar spirit, a ghost
Klonas?	Who knows?	Talapus	Coyote
Kloshe	Good	Tukamonuk	One hundred
Kula Kula	Bird	Tum Tum	The plan, the heart, the will, belief, mind
Laly	Time	Tumwata	Waterfall
Lapote	Door	Wake	No, not, none

LESSON 6: CHAPTER 5 – PLEISTOCENE SAFARI

TRANSLATION PRACTICE

Use this space to create your own greeting using your Chinook Dictionary or translate the thunderbird-summoning chant that Jenna uses in Chapter 4!

CHAPTER 5 QUESTIONS

1. Explain how the characters arrive *before* the flood.

2. Of all the animals the characters have seen so far, which is the most interesting to you?

Why?

LESSON 8: CHAPTER 7– COUNCIL CREST

CHAPTER 7 QUESTIONS

1. What do Ari, Jenna, and Caleb need in order to get home to their own time?

2. Where do the characters find the chant that will send them home?

3. Describe how the kids build a time travel compass.

4. Use your Chinook dictionary to translate the chant: *Klatawa Laly Tum Tum Killapi Illahee*

VOCABULARY– REVIEW THE FOLLOWING TERMS WITH YOUR TEACHER

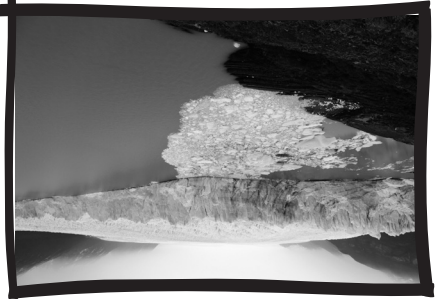
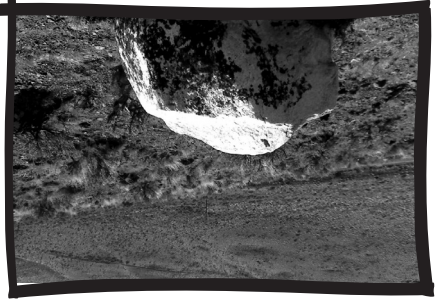
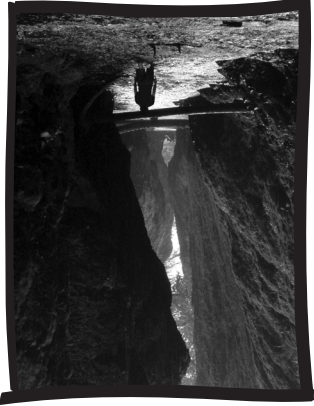
Compass-

Magnetic Compass-

Cardinal Directions-

Intermediate Directions-

Compass Rose-



ICE DAM:

In this picture I see ice blocking the flow of water and creating a pond or lake just like the ice Dam in the Missoula Flood but on a smaller scale.

COLUMBIA RIVER GORGE:

CHANNELLED SCABLANDS:

CAMAS PRAIRIE RIPPLES:

DRY FALLS:

MYSTERY PICTURE!

READ THE INSTRUCTIONS FROM THE POWERPOINT AND FILL IN THE CHART AS EACH ANIMAL IS DISPLAYED

ANIMAL	DIED OFF	STILL ALIVE	RELATED TO...
SABER-TOOTHED CAT			
GIANT SHORT-FACED BEAR			
JEFFERSON GROUND SLOTH			
GUENTHIN'S PRONGHORN			
DIRE WOLF			
COLUMBIAN MAMMOTH			
WOOLY MAMMOTH			
CAMELOPS			
WESTERN HORSE			
ELK			
CHICKADEE			
LONG-HORNED BISON			

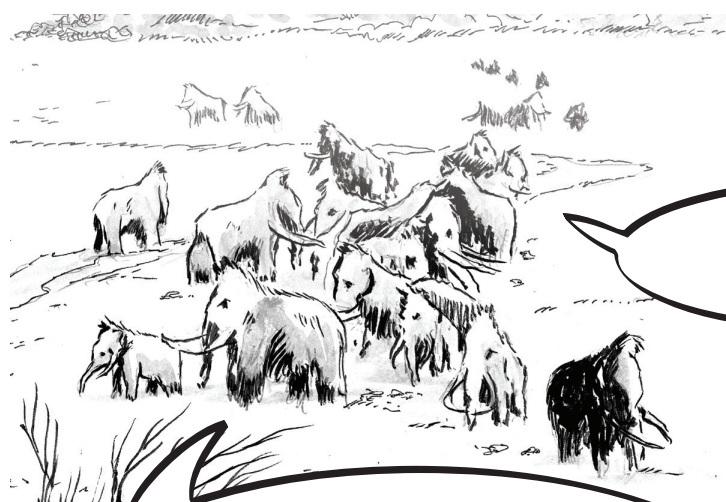
THEORIES OF EXTINCTION

1. Many animals were hunted to extinction.
2. Changes in the climate were too great for the mammals to adapt to. For instance, climate change alters plants and there may not have been enough food for these large animals.
3. Disease— new climates have new types of bacteria and viruses that may have killed the large mammals off.
4. Your theory:

PLEISTOCENE SAFARI ACTIVITY

Create a guide to the animals seen by the characters!

- Write a fact about the animal in the dialogue bubble provided. Dialogue for the elk is given as an example.
- Remember to include the animal's name.
- When you are done, color your guide!



YOU SHOULD ALREADY HAVE WALLULA GAP, COLUMBIA RIVER GORGE, DRY FALLS, PORTLAND, AND THE PACIFIC OCEAN LABELED ON YOUR MAP.

NOW LABEL:

- The Ice Dam
 - Channeled Scablands
 - Camas Prairie Ripples
 - Lake Lenore Caves
- ONCE YOUR TEACHER CLICKS ON THE RANGE MAP, LABEL AND SHADE:
- The Cordilleran Ice Sheet
 - Lake Missoula
 - The area of the flood path

COMPARE THE MAP YOU BEGAN WITH WITH THIS ICE AGE FLOOD MAP!

List at least three things that exist on your Ice Age Flood map that do not exist in modern times:

1. _____
2. _____
3. _____

MATCHING ACTIVITY

The Camas Prairie Ripples, Channeled Scablands, Dry Falls, Lake Lenore Caves, and Columbia Gorge were created or carved in part by water from the Missoula Floods. But water creates similar features whether it's from a great flood, the ocean, a river, or rain! This is because water is scale independent, or behaves the same on large and small scales. On the next page, the left-hand column shows similar features to those you labeled on your map. Draw a line connecting the pictures to the ones created during the flood and describe how they are similar and different. Beware! There is one picture that doesn't fit, but it is something you have heard of. Which is it?

LESSON 7: CHAPTER 6 – FLOOD PATHS

CHAPTER 6 QUESTIONS

1. The first lake Jenna, Ari, and Caleb fly over is Lake Columbia. What does Ari say will happen when the ice dam breaks?

2. In your own words, describe the ice dam and Lake Missoula. (Remember Chapter 2 size comparisons.)

3. Once the ice dam breaks and all that water is let loose, it washes across the land. Give at least three observations about the flood and its path.

1.
2.
3.

4. When Ari says he'll never look at water the same way again, what do you think he means?

5. How do you think the flood has impacted, or changed the Pacific Northwest?

