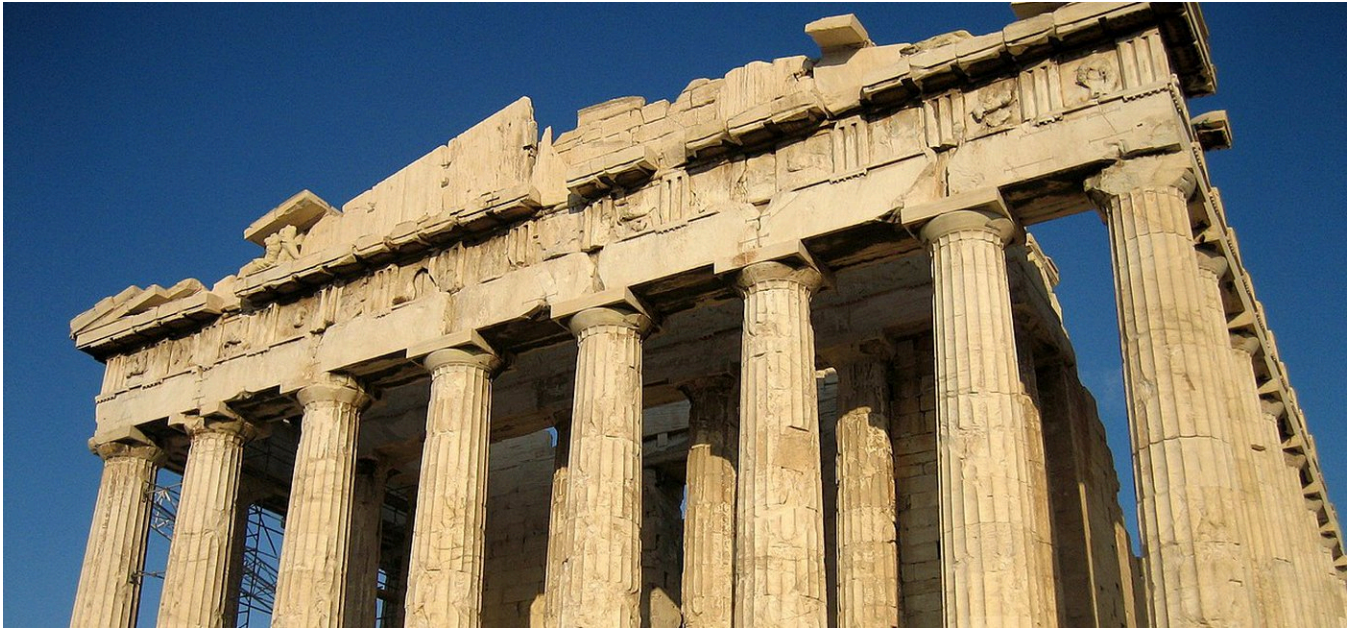


Endings and Legacy

Extinction, Memory, and What We Leave Behind

Name _____ Class _____ Date _____

PART 1: EVERYTHING ENDS



The Parthenon in Athens, built almost 2,500 years ago. The society that built it is gone, but its ideas still shape our world.

Nothing lasts forever, and that includes our planet, our star and perhaps the universe itself. In roughly a billion years, the slowly brightening Sun will boil away Earth's oceans. About five billion years from now, the Sun will run out of hydrogen in its core and swell into a red giant, scorching the inner planets and perhaps swallowing Earth altogether. On a larger scale, astronomers long expected our galaxy, the Milky Way, to collide with the Andromeda galaxy in about 4.5 billion years. A study published in 2025, however, put the chance of a collision within the next ten billion years at only about fifty percent. On the longest timescales of all, many physicists expect the universe itself to end in heat death, a state of maximum entropy in which no energy is available to do work, no stars shine, and nothing ever happens again.

Endings do not require cosmic timescales, however. The average mammal species is thought to last roughly a million years, and *Homo sapiens* has existed for about 300,000, which makes us young in evolutionary terms. Human civilizations are far more fragile. The western Roman Empire lasted about 500 years, and ancient Egypt endured for an extraordinary 3,000. The Maya cities, the Khmer Empire and the Aztec Empire all rose, flourished and fell. Every civilization that has ever existed has either collapsed or is still running, so the question is not whether ours will end but what we will leave behind when it does.

PART 2: THE FERMI PARADOX REVISITED

The first two lessons of this series introduced the Dark Forest Theory and the Fermi Paradox: if the universe is so vast, where is everyone? This final lesson offers a sobering possible answer, which is that they are all gone. The Great Filter from Lesson 2 may not be a single catastrophic event but a pattern. Civilizations develop powerful technology, face existential risks, and mostly fail to survive them. Nuclear war, climate collapse, engineered pandemics, uncontrolled artificial intelligence and asteroid impacts all belong on the list of threats, and the list is growing. Perhaps the universe is full of ruins: dead worlds where intelligent life once thrived, built great things, and then disappeared.

The astronomer Carl Sagan captured this sense of fragility in his reflection on the Pale Blue Dot, a photograph in which our entire planet appears as a tiny speck of light in a ray of scattered sunlight. "Look again at that dot," he wrote. "That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives." Everything we are is compressed into less than a single pixel.



The Pale Blue Dot. Earth, the small point of light in the center, photographed by Voyager 1 from about 6 billion kilometers away on February 14, 1990.

Image: NASA/JPL-Caltech (public domain)

"To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known."

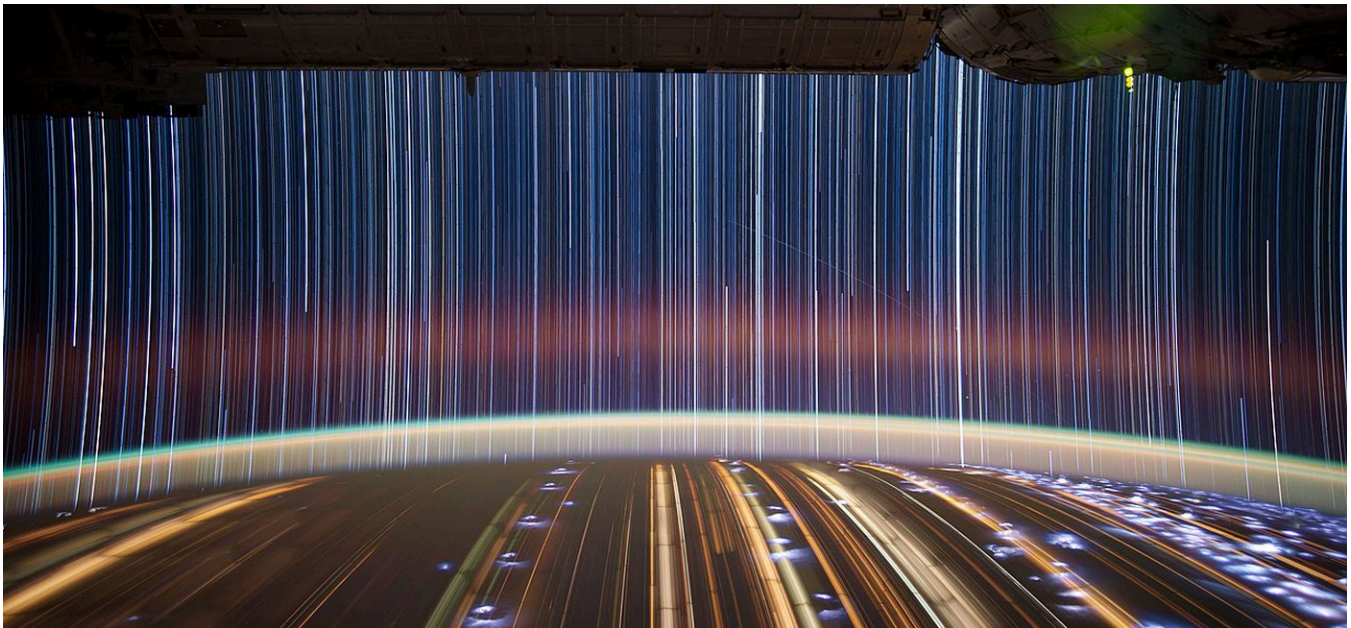
Carl Sagan, Pale Blue Dot, 1994

PART 3: WHAT SURVIVES?

If a civilization knew that it would end, what should it try to preserve? The answer reveals what that civilization values most. The ancient Egyptians built monuments, and the pyramids have stood for 4,500 years, long outlasting the society that created them. The Greeks left ideas such as democracy,

philosophy, mathematics and theater, while the Romans left roads, aqueducts and legal systems. No civilization fully controls what survives, however. The pyramids endure because stone is durable, while Greek philosophy survives only because later scholars in Constantinople, Baghdad and elsewhere copied and preserved the texts.

Modern humans have attempted more deliberate preservation. The Svalbard Global Seed Vault, which opened in 2008 inside a frozen mountain in Norway, now stores more than 1.4 million samples of crop seeds as a backup against war and disaster. The Voyager Golden Records carry sounds, images and music into interstellar space. In Texas, the Long Now Foundation is building a clock inside a mountain that is designed to keep time for 10,000 years, a project meant to encourage long-term thinking in a species obsessed with the immediate.



Star trails above and city lights below, in a long exposure taken from the International Space Station

Photo: NASA (public domain)

Liu Cixin gives this question a memorable scene in *Death's End*. Fearing that the solar system may one day be destroyed, humanity builds a museum of its civilization on Pluto and asks its scientists how to make information last for an immense span of time. After studying every advanced storage technology, they reach an answer that would have been familiar to the Egyptians: carve the words into stone.

PART 4: THE MEANING OF LEGACY

In 1818, the poet Percy Bysshe Shelley published a short poem about Ozymandias, the Greek name for the Egyptian pharaoh Ramesses II. A traveler describes the ruins of a colossal statue in the desert, whose base carries the inscription: "Look on my Works, ye Mighty, and despair!" Nothing else remains of the king's empire, and the sands stretch away on every side. The poem is a meditation on the impermanence of power and on the arrogance of rulers who believe they can defeat time. There is an irony in it as well, because the poem itself has now lasted for more than two hundred years. Shelley's fourteen lines have outlived most of the empires of his own era.

This is perhaps the deepest lesson of the series: legacy is not about size or power. The civilizations we remember best are not always the ones that conquered the most territory or built the tallest buildings. We remember Athens more fondly than Sparta, and we study Shakespeare more closely than the monarchs he performed for. Ideas, stories and art have a durability that empires lack. If humanity's time is limited, as it surely is, then the question for each of us is not only "How do I survive?" but also "What can I create that is worth remembering?"

KEY VOCABULARY

Term	Meaning	Term	Meaning
<i>luminosity</i>	the amount of light or energy given off by a star	<i>heat death</i>	a possible end state of the universe in which no usable energy remains
<i>fragile</i>	easily broken or destroyed	<i>pandemic</i>	a disease that spreads across many countries or the whole world
<i>monuments</i>	large structures built to preserve the memory of a person or event	<i>legacy</i>	what a person, civilization or era leaves behind
<i>long-term thinking</i>	planning and acting with the distant future in mind	<i>impermanence</i>	the fact of not lasting forever
<i>entropy</i>	a measure of disorder; the tendency of systems to run down over time	<i>existential</i>	relating to existence; an existential risk threatens total destruction
<i>durability</i>	the ability to last and to withstand wear or damage	<i>meditation</i>	deep, extended thought on a subject (literary use)
<i>arrogance</i>	excessive pride or self-importance	<i>Ozymandias</i>	the Greek name for Pharaoh Ramesses II; in Shelley's poem, a symbol of fallen power
<i>preserve</i>	to keep something safe from harm or decay	<i>ruins</i>	the remains of buildings or cities that have decayed or been destroyed
<i>collide</i>	to crash into something with force	<i>humility</i>	a modest view of one's own importance

Discussion & Analysis

Endings and Legacy · Lesson Activities

A. COMPREHENSION

1. According to the reading, what will happen to Earth in about one billion years, and in about five billion?

2. What is heat death, and why would it be the ultimate ending?

3. How does the reading connect the Fermi Paradox to the idea of endings?

4. Why have the pyramids and Greek philosophy survived? Give the reason for each.

5. Name three deliberate preservation efforts mentioned in the reading.

6. In Death's End, what do the scientists conclude is the best way to make information last?

7. What is the irony of Shelley's poem "Ozymandias"?

8. According to the reading, what lasts longer than empires?

B. VOCABULARY IN CONTEXT

Complete each sentence with a term from the vocabulary list. Use each term once.

arrogance · durability · existential · fragile · impermanence · legacy · luminosity · meditation ·
monuments · pandemic

1. The COVID-19 outbreak became a global _____ that affected nearly every country on Earth.
2. The pharaohs built massive stone _____ that have survived for thousands of years.
3. Democracy is part of the _____ of ancient Greece, an idea that outlived its creators by millennia.
4. Human civilization is surprisingly _____, and a single catastrophe could bring it to an end.
5. The king's _____ was his downfall, since he believed that no enemy could ever defeat him.
6. A large asteroid impact would be an _____ threat to life on Earth.
7. The poem is a _____ on the meaning of power and the passage of time.
8. Stone was chosen for its _____; almost nothing else lasts as long.
9. As the Sun's _____ slowly increases, Earth will become too hot for liquid water.
10. The ruined statue is a reminder of the _____ of even the greatest empires.

C. CRITICAL THINKING

1. If you could preserve only three things to represent humanity to a future civilization, what would you choose? Explain each choice.

2. The reading says we remember Athens more fondly than Sparta. What does this mean? Do you agree that ideas last longer than military power?

3. Carl Sagan hoped the Pale Blue Dot would inspire humility and kindness. Does knowing that Earth is a tiny speck make you feel small, or does it motivate you? Why?

4. Looking back across all eight lessons in this series, which idea affected you the most, and why?

D. TIME CAPSULE PROJECT

Design a time capsule for the year 3026, one thousand years from now. Assume it will be opened by humans or by another intelligent species. Choose ONE item for each category and be ready to explain your choice.

1. A Book

Which single book best represents human thought, creativity or knowledge?

2. A Sound

A piece of music, a speech or a natural sound. What should the future hear from our time?

3. An Image

One photograph or artwork that shows who we were.

4. An Object

A physical object that tells a story about how we lived. It need not be our best technology.

5. A Warning

What should the future learn from our mistakes? Write it in one sentence.

6. A Hope

What do you hope the future has achieved that we could not? Write it in one sentence.

My six choices:

E. SERIES REFLECTION: CONNECTING THE LESSONS

This is the final lesson. Look back across the whole series and discuss these questions. If you have not studied the earlier lessons, answer question 4 and discuss the others using this reading alone.

1. How does the Dark Forest Theory (Lesson 1) connect to the idea of legacy? If civilizations hide, can they leave one?

2. Hibernation (Lesson 3) is a way to wait out an ending, and living in space (Lesson 4) is a way to escape one. Which approach seems wiser to you, and why?

3. Scarcity (Lesson 5) and the ethics of technology (Lesson 7) both deal with choices made under pressure. What do they suggest about how humans behave when the stakes are highest?

4. If you could add a Lesson 9 to this series, what would it be about, and why?

F. ESSAY PROMPT

Choose ONE of the following and write a well-organized essay of 300 to 500 words on a separate sheet of paper.

- Option A: "The meaning of life is not survival; it is legacy." Do you agree or disagree? What gives a life or a civilization meaning when everything eventually ends?
- Option B: Write your own Pale Blue Dot reflection. Imagine that you are looking back at Earth from the edge of the solar system. What would you say to the people on that tiny speck of light?
- Option C: Choose one civilization that has ended, such as the Roman, the Egyptian or the Maya. What was its greatest legacy, and what can its rise and fall teach us about our own future?

Plan your essay in the box before you write: your main claim, your supporting points, and your conclusion.

Teacher's Notes & Answer Key

Endings and Legacy · Instructor Guide

LESSON OVERVIEW

LEVEL

Advanced (CEFR B2 to C1)

DURATION

60 to 90 minutes

FOCUS

Reading, reflection, creative project, series review

Source material: Astronomy of the far future; Carl Sagan; Shelley's "Ozymandias"; Liu Cixin's Death's End

Series: Humans & The Universe, Lesson 8 of 8, the finale. Best after the earlier lessons, but it works as a standalone lesson.

SUGGESTED LESSON FLOW

Warm-up (5 min)	Ask: if humanity had 100 years left, what should we do with the time? Open discussion.
Pre-reading (5 min)	Key vocabulary: legacy, impermanence, entropy, existential, luminosity.
Reading (15 to 20 min)	Parts 1 to 4. Read the Sagan passage aloud, because it is powerful when spoken.
Comprehension (10 min)	Section A.
Vocabulary (10 min)	Section B. Ten gaps, word bank supplied.
Time capsule (15 to 20 min)	Section D, alone or in pairs. Students present their choices to the class. This is the signature activity of the finale.
Series reflection (10 to 15 min)	Section E connects themes across all eight lessons and works best with students who have completed the series.
Homework	Section F essay. Option B, writing your own Pale Blue Dot, is the strongest final assignment.

ANSWER KEY: SECTION A (COMPREHENSION)

1. In about one billion years the brightening Sun will boil away the oceans. In about five billion years the Sun will swell into a red giant, scorching the inner planets and perhaps swallowing Earth.
2. A possible end state of the universe in which entropy is at its maximum: no usable energy remains, no stars shine and nothing happens. It would be the ultimate ending because it is total and permanent.
3. The silence of the universe may mean that civilizations develop powerful technology, face existential risks and mostly do not survive them. The universe could be full of the ruins of extinct intelligent species. This is the Great Filter seen as a repeating pattern.
4. The pyramids have survived because stone is durable. Greek philosophy has survived because later scholars copied and preserved the texts. Neither civilization fully controlled what would last.
5. The Svalbard Global Seed Vault (more than 1.4 million crop seed samples stored in a frozen mountain), the Voyager Golden Records (sounds and images sent into interstellar space) and the Long Now Foundation's clock (designed to keep time for 10,000 years).

6. That the most reliable way to preserve information over an immense span of time is to carve it into stone.
7. Ozymandias boasted that his works would make the mighty despair, yet his statue is broken and his empire has vanished. The further irony is that a poem about the failure of his monument has itself lasted more than two hundred years.
8. Ideas, stories and art.

ANSWER KEY: SECTION B (VOCABULARY)

1. pandemic 2. monuments 3. legacy 4. fragile 5. arrogance 6. existential 7. meditation
8. durability 9. luminosity 10. impermanence

SERIES TEACHING NOTES

For students completing all eight: This lesson is designed as a finale. Section E ties together themes from every lesson, so allow extra time for it; students often have strong views about the series as a whole.

Assessment idea: Essay option B makes an excellent final assessment for the series. It tests writing, critical thinking and the ability to draw themes together.

Recommended reading: Read the full Pale Blue Dot passage aloud to close the series. It is widely available online and takes about three minutes.

Link to Lesson 2: Remind students that the Voyager spacecraft carrying the Golden Records also took the Pale Blue Dot photograph, and that Voyager 1 reaches one light-day from Earth in November 2026.

Section D: Push students past the obvious. Ask what the capsule would look like to someone who cannot read any human language, which connects back to the message design task in Lesson 2.

Section E: Question 4 works for every student, including those new to the series. Good proposals for a Lesson 9 name a real-world issue, a science fiction premise that mirrors it, and a question that reasonable people would answer differently.

KEY DISCUSSION LANGUAGE

Reflecting

"Looking back, what stands out is..."

Legacy

"What matters most is..." / "This will be remembered because..."

Connecting

"The theme across these lessons is..."

Perspective

"When you consider the scale of..."

Personal

"This changed how I think about..."

Hope

"Despite everything, I believe..."

Sources & Further Reading

Carl Sagan, Pale Blue Dot: A Vision of the Human Future in Space (1994). The photograph was taken by Voyager 1 on February 14, 1990.

Milky Way and Andromeda: Sawala et al., Nature Astronomy (2025).

Svalbard Global Seed Vault: more than 1.4 million seed samples as of 2026 (Crop Trust and the Government of Norway).

Percy Bysshe Shelley, "Ozymandias" (1818). The Long Now Foundation, the 10,000 Year Clock.

Liu Cixin, Death's End (2010).

Humans & The Universe

An eight-lesson advanced reading and discussion series

This lesson completes a connected series for advanced learners. Each lesson pairs a science fiction premise with the real science, history and ethics behind it, and each works as a standalone class or as part of the full sequence.

1	The Dark Forest: game theory, deterrence and the fate of civilizations	
2	Should We Answer? SETI, the Fermi Paradox and the risk of saying hello	
3	Waking Up in the Future: hibernation, time and the cost of survival	
4	Living in Space: survival, adaptation and leaving Earth behind	
5	Scarcity and Survival: resources, rationing and who gets to live	
6	First Contact Protocols: diplomacy, danger and speaking for humanity	
7	The Ethics of Technology: power, responsibility and dangerous tools	
8	Endings and Legacy: extinction, memory and what we leave behind	<i>you are here</i>

Lesson 1, The Dark Forest, is a free download from Tahric Teaches on Teachers Pay Teachers.