

## Wilson Area School District Planned Course Guide

**Title of planned course:** Science of the Universe

**Subject Area:** Science

**Grade Level:** 12 and transfer students

**Course Description:** Science of the Universe will include discussion of astronomy, astrophysics, astrobiology and cosmology. The features of the Solar system including the Earth and its moon, the other planets and all of their moons, the asteroids and comets, and of course the energy source of our system; the sun will be discussed.

Beyond our solar system, we will talk about the formation and life cycle of stars, planets and galaxies. The unit on cosmology will focus on the Big Bang, the size and shape of space, and potential end-states of the universe. The course will involve many online sources of information including official NASA websites, as well as educational content from video creators.

**Time/Credit for this Course:** 1 period per day; 2 days/week; 1 semester / 0.5 credit

**Curriculum Writing Committee:** Jarrod Gibson

# Curriculum Map

<b><u>August / January:</u></b>	Early Astronomy
<b><u>September / February:</u></b>	About the Earth The Earth and Moon System, NASA and the Space Race Telescopes
<b><u>October / March:</u></b>	The Solar System, Planets and Belts
<b><u>November / April:</u></b>	Life Cycles of Stars Black Holes
<b><u>December / May:</u></b>	Aliens and Astrobiology Cosmology
<b><u>January / June:</u></b>	Cosmology Final Exams

## **Wilson Area School District Planned Course Materials**

**Course Title:** The Science of the Universe

**Teacher Resources:**

Stellarium Web Version or Download  
Starry Night  
Imagine the Universe  
The Universe at Your Fingertips  
NASA websites  
Hayden Planetarium/ American Museum of Natural History  
McDonald Observatory

EXTREMELY Relevant Video Channels:

1. Kurzgesagt - In a Nutshell
2. Crash Course Astronomy
3. PBS Spacetime

# Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** Early Astronomy

**Time frame:** 1 week

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the work of ancient astronomers
- Identify Key Individuals pertaining to astronomical history including Aristotle, Copernicus, Kepler, Galileo, Newton
- Understand the relationship between Religion, Politics and Science during the early ages of astronomy
- Explain a few key discoveries and equations, such as how we know the Earth is round and know it's circumference and Kepler's laws of Planetary Motion

**Core Activities:** Students will complete/participate in the following:

- Galilean Moons Activity

**Extensions:**

- Investigate Early Astronomers
- Research an Early European Astronomer and note their contributions/discoveries in the field of astronomy

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Direct Instruction/ Lecture
- Powerpoint Presentation
- Videos
- Student Research/ Presentation

**Assessments:**

- Individual Student participation
- Google Form Homework Assignment
- Quiz/ Formal Exam
- Other individualized assessment strategies as necessary

## Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** About the Earth

**Time frame:** 1 week

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the general characteristics of the Earth; mass, volume, tilt, rotational and orbital period, atmosphere, magnetosphere
- Discuss and understand the term ecliptic and use it to explain seasons, solstices and equinoxes.
- Use local and celestial coordinates to locate and identify constellations within the night sky.

**Core Activities:** Students will complete/participate in the following:

- The Ecliptic Project
- Stellarium- Find Constellations

**Extensions:**

- Students can research specific constellations and find one that may be visible in the Northern Hemisphere at the right time of year (Fall/ Spring)
- Group observation nights could be held to view constellations

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Direct Instruction/ Lecture
- Powerpoint Presentation
- Videos
- Student Research/ Presentation

**Materials & Resources:** Stellarium Download

**Assessments:**

- Individual Student participation
- Google Form Homework Assignment
- Quiz/ Formal Exam
- Other individualized assessment strategies as necessary

# Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** The Earth - Moon System, NASA, and the Space Race

**Time frame:** 2-3 weeks

**State Standards:** 3.3.10.B1

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the Earth - Moon - Sun System
- Compare/ Contrast the size and distance to Earth for both the Sun and Moon and how it contributes to eclipsing
- Describe the size, shape, mass, gravitational influence, atmosphere (or lack of) properties of the moon
- Explain the leading theories on how the moon
- Understand the ambitions, goals and actions of NASA and the US during the space race and describe its lasting impacts
- Discuss various strategies (i.e. project paperclip) and outcomes of the Space Race

**Core Activities:** Students will complete/participate in the following:

- Moon Phases Observation Project : 1 Month

**Extensions:**

- Learn more of the lasting effects of the Space Race. Have we made progress as far as the moon is concerned since the lunar landings?
- Further explore project paperclip and the politics during the cold war and space race. Was the public at the time AWARE of the people being brought in to work for NASA?

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:** Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary

## Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** Telescopes

**Time frame:** 1-2 weeks

**State Standards:** 3.2.12.A2, A3

**Essential content/objectives:** At end of the unit, students will be able to:

- Explain the primary use, types (and subtypes) and functions of telescopes
- Identify Sub-types of telescopes, Cassegrain, Schmidt Cassegrain and Newtonian
- Understand the electromagnetic spectrum
- Describe the connection between regular (visible) light and other forms of electromagnetic radiation

**Core Activities:** Students will complete/participate in the following:

- Observe Solar Spectrum through Spectrograph. Sunlight has all the colors in it.

**Extensions:**

- If possible, use a low power telescope at night. Possibly as an extracurricular event. Gather at a common meeting place, observe stars or planets with a telescope.

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:** Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary

# Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** The Solar System Planets and Belts

**Time frame:** 4-5 weeks

**State Standards:** 3.3.12.B1

**Essential content/objectives:** At end of the unit, students will be able to:

- Identify and describe key features of each of the 8 planets
- Understand the reasoning behind Pluto's classification as a dwarf planet
- Describe the formation and constitution of the asteroid belt
- Compare and Contrast the Kuiper belt with the asteroid Belt

**Core Activities:** Students will complete/participate in the following:

- Hallway Solar system

**Extensions:**

- Students will choose one planet for a "deep dive" to present new information, latest NASA updates and overall become an "expert" on the planet. Can be accompanied by research paper or presentation

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:** Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary



## Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** The Life Cycle of Stars

**Time frame:** 2 weeks

**State Standards:** 3.3.12.B1

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the life cycle of a star
- Describe the future of the Sun (red giant, white dwarf)
- Identify solar leftovers, such as white dwarfs, neutron stars and black holes
- Describe the end of the life cycle for a high mass star
- Explain how stars produce light and heat energy
- Describe how stars life cycle is balanced around hydrostatic equilibrium
- Explain how color of starlight can inform us of temperature, as well as elements present
- Determine the inverse relationship between mass of a star and lifetime

**Core Activities:** Students will complete/participate in the following:

- How Big is That Star? (Imagine the Universe)
- McDonald Observatory Activities
- Colors of Stars
- Lives of Stars

**Extensions:**

- Students will choose a star to research and compare to our Sun. Red dwarfs will be smaller and live longer. Super/Hyper Giants will live “short” lives. How would your star fit into our solar system if we replaced the sun?

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:** Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary

# Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** Black Holes

**Time frame:** 2 weeks

**State Standards:** 3.3.12.B1

**Essential content/objectives:** At end of the unit, students will be able to:

- Explain what a black hole is and how one forms and what factors must be present for such an event to occur
- Describe a black hole as a celestial object.
- Theorize the potential uses and dangers of black holes

**Core Activities:** Students will complete/participate in the following:

- Turning Various Objects into Black Holes
- Supermassive “Sagittarius A\* “
- “Stretch table” spacetime demonstration

**Extensions:** Students can learn more about super massive black holes to present to the class.

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:**Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary

## Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** Aliens and Astrobiology

**Time frame:** 2 weeks

**State Standards:** 3.3.12.B2

**Essential content/objectives:** At end of the unit, students will be able to:

- Discuss the possibility and probability of life within the universe
- Describe the Fermi Paradox and some possible solutions
- Provide proposals as to why we haven't found alien life yet
- Describe the habitable zone, and furthermore some of essential qualities needed for life
- Describe the Kardachev scale as it pertains to civilizations and place Earth appropriately on that scale
- Propose some candidates within our solar system where extraterrestrial life may be possible

**Core Activities:** Students will complete/participate in the following:

- Research a proposed resolution to the Fermi Paradox
- Provide various hypotheses as to why we do not see Aliens if space is so big and has been around so long

**Extensions:**

- Further research NASA's search for extraterrestrial life, or explore SETI, the national Search for Extra-Terrestrial Intelligence

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:** Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary

# Curriculum Scope & Sequence

**Planned Course:** The Science of the Universe

**Unit:** Cosmology, the study of universe formation

**Time frame:** 2 weeks

**State Standards:** 3.3.10.B1

**Essential content/objectives:** At end of the unit, students will be able to:

- Describe the evidence for the Big Bang and describe the Big Bang Theory with some detail
- Describe the shape and size of the Universe today
- Explain the observable universe
- Understand or intuit the vastness of space and cosmic distance
- Describe dark matter

**Core Activities:** Students will complete/participate in the following:

- Imagine the Universe Activities
  - Evidence for Hidden Mass
  - Dark Matter Possibilities
- How might the universe end?
- Evidence of the Big Bang and Cosmic Inflation

**Extensions:** Research current experiments aimed at uncovering the future of the Universe

**Remediation:** Teacher directed based on teacher formative assessment

**Instructional Methods:**

- Student research / presentations
- Direct instruction
- PowerPoint presentations/ notes
- Cooperative learning structures
- Guided practice
- Videos

**Materials & Resources:** Imagine the Universe (Internet based)

**Assessments:**

- Individual participation / consultation
- Quizzes
- Test
- Other individualized assessment strategies as necessary