

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 studies of the big bang theory and the formation of the universe. Concepts will include the formation of elements up to iron (including nuclear reactions), the formation of stars and planets, and other “exotic” objects in the universe. It will include how electromagnetic radiation is used to determine the composition of stars and planets. The course will utilize up-to-date news and information from NASA.

Time/Credit for this Course: 1 period per day; 5 days/week; 1 semester;
0.5 credit

Curriculum Writing Committee: Carolyn Evans

Curriculum Map

August / January: The Science of Astronomy and Cosmology

September / February: Astronomical Tools
The Big Bang Theory and the Formation of the Universe

October / March: Building Blocks of the Universe: Formation of Elements
Cosmic Objects

November / April: Life Cycle of Stars
Galaxies

December/ May: Space and Time; Space and Gravity
Dark Matter and the Fate of the Universe

January / June: Black Holes, Wormholes, Life in other worlds, Time Travel
Final Exams

Wilson Area School District Planned Course Materials

Course Title: The Science of the Universe

Teacher Resources:

Starry Night

Imagine the Universe

The Universe at Your Fingertips

NASA websites

Hayden Planetarium/ American Museum of Natural History

McDonald Observatory

Curriculum Scope & Sequence

Planned Course: The Science of the Universe

Unit: The Science of Astronomy and Cosmology

Time frame: 1 week

State Standards: 3.3.12.B2

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

- Differentiate between astronomy and cosmology
- Discuss the development of astronomy and cosmology including Aristotle, Copernicus, Kepler, Galileo, Newton, Hubble, Einstein, Hawking

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

- Modeling the Universe Activities
 - Modeling the Universe
 - Tour of the Invisible Universe
 - Cosmic Survey

Extensions:

- Investigate other scientists who have contributed to the advancements in astronomy and cosmology

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: Astronomical Tools

Time frame: 2 weeks

State Standards: 3.3.10.B2; 3.3.12.B2

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

- Define and use measuring units relevant to astronomy and cosmology
- Discuss the uses of electromagnetic radiation in determining the composition of distant stars and planets
- Read and interpret line spectra
- Discuss the different types of telescopes / satellites which enable scientists to analyze the universe
- Describe the purpose of the different telescopes
- Interpret a light of novae, supernovae, and variable stars

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

- McDonald Observatory Activities
 - Astro-madness
 - Tour of the Universe
 - The inverse Square Law of Light
 - Parallax
 - The Scale of the Realms
 - Scientific Models
 - Timeline
 - Measuring the Angled Size of a Person

Extensions:

- Students will research a specific telescope / observatory discussing its role in the “big picture”

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:

- McDonald Observatory

Assessments:

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

Curriculum Scope & Sequence

Planned Course: The Science of the Universe

Unit: The Big Bang Theory and the Formation of the Universe

Time frame: 3 weeks

State Standards: 3.3.10.B1

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

- Discuss current information that supports the big bang theory the explanation for the beginning of the universe

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

- Examination of cosmic microwave background radiation and other data that supports the big bang theory

Extensions:

- Students will research on-going scientific endeavors (such as the search for the Higgs-Boson particle) which help to explain the origins 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

Curriculum Scope & Sequence

Planned Course: The Science of the Universe

Unit: Building Blocks of the Universe: Formation of Elements

Time frame: 2 weeks

State Standards: 3.2.12.A2, A3

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

- Discuss the types of nuclear reactions
- Predict the products of nuclear reactions
- Apply the Law of Conservation of Matter and Energy to the formation of matter

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

- X-ray Spectroscopy (Imagine the Universe)

Extensions:

- Students will research the use of nuclear energy for power

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: Cosmic Objects

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 variety of objects in our universe

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

- Imagine the Universe Articles: Cosmic Objects
(<http://imagine.gsfc.nasa.gov/science/objects/objects.html>)
- How Far? How Powerful? (Imagine the Universe)
- Supernova Chemistry! (Imagine the Universe)

Extensions:

- Students will choose a cosmic object and research it

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
- Determine the type of star from spectral data
- Discuss neutron stars and black holes

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

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
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- Other individualized assessment strategies as necessary

Curriculum Scope & Sequence

Planned Course: The Science of the Universe

Unit: Galaxies

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 formation of galaxies including the effect of various force on the outcomes

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

- McDonald Observatory Activities
 - Coma Cluster of Galaxies
 - False Color
 - Multiwavelength Astronomy
 - Make Your Own Galaxy
- Star Date Activities
 - Stars and Galaxies
 - The Milky Way
- Active Galaxies Activities
 - An Active Galaxy
 - Light Travel Time and the Size of Active Galaxies
- Imagine the Universe Activities
 - Identifying Galaxies
 - Classifying Galaxies with Hubble's Fork Diagram
 - Identifying Unusual Galaxies
 - Open Clusters vs. Globular Clusters
 - Modeling Mass in a Solar System and a Galaxy
 - Weighing a Galaxy
 - The Universe as We Know It

Extensions:

- Student will choose another galaxy and compare it to our Milky Way.

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: Space and Time; Space and Gravity

Time frame: 1 week

State Standards: 3.3.12.B2

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

- Discuss Einstein's Revolution and the concept of Relative Motion
- Discuss Einstein's Second Revolution
- Discuss The Equivalence Principle
- Provide an Understanding of Spacetime
- Discuss A New View of Gravity
- Apply current data and ideas to a Scientific History of the Universe

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

- http://www.pbs.org/wgbh/nova/education/activities/3213_einstein.html
 - The Building of Ideas
 - Energy's Invisible World
 - Messing with Mass
 - Squaring Off with Velocity
 - A Trip to Pluto
 - Who did What When?

Extensions:

- Student will research another scientist who made a major contribution to astronomy and / or cosmology

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: Dark Matter and the Fate of the Universe

Time frame: 2 weeks

State Standards: 3.3.10.B1

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

- Describe various unknowns about astronomy and cosmology: Dark Matter, Structure Formation, The Fate of the Universe

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

- Imagine the Universe Activities
 - Evidence for Hidden Mass
 - Dark Matter Possibilities

Extensions:

- Student will research the Higgs-Boson particle

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, Wormholes, Life in Other Worlds and Time Travel

Time frame: 1 week

State Standards: 3.3.10.B1

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

- Speculate and provide evidence for the existence of “exotic” structures in the universe like black holes and wormholes
- Discuss the formation of life on Earth
- Discuss the possibility of the existence of life / extraterrestrial intelligence elsewhere in the galaxy and the necessary evidence for life
- Discuss the concept of multiverses

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

- Imagine the Universe Activities
 - Apparently, They Are Absolutely Bright
 - It's Either Probable, or It's Not
 - Blast from the Past
 - A Sensitive Situation
 - When You're Hot, You're Hot...Unless You're Not
 - Behind the Gamma-Rays
 - The Power of These
 - True or False
 - About Once a Day
 - Model a Black Hole
 - Aluminum Foil, Balloons, and Black Holes
 - Gravity Is as Gravity Does
 - Testing Einstein
 - Crossing the Event Horizon
 - How Much Do You Know?
 - Inevitable Mathematics

Extensions:

- Students will write an essay on their opinion on extraterrestrial life and use evidence to support their opinion

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