

Unit 1: Development and Practice of Astronomy (Earth and Space Science) Copied from: Astronomy (Earth and Space Science), Copied on: 12/15/21 Copied on: 05/31/22

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Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

ASTRONOMY, GRADE 11-12

Unit I: Earth, Moon, and Sun

Belleville Board of Education

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Unit Overview

Unit I is an introduction to astronomy, relating astronomical and physical concepts to nearby and familiar celestial bodies such as the Sun, the Moon, and Earth itself. Significant attention is paid to renewing and building upon the understanding gained in elementary school, especially as it pertains to everyday phenomena like the seasons; the tides; and the phases of the moon. The practical skill of orienteering is developed. Critical foundations are laid for an evidence-based understanding of the origins of Earth and life, even as we honor Galileo and the proud tradition of evidence in the battle against superstition, pseudoscience, and misinformation. Finally, historical and anthropological connections are made as we examine the impact astronomy has had on the human species from the neolithic period through the age of exploration; into the modern era, and beyond.

Enduring Understandings

Unit Enduring Understandings

- Evidence-first methods such as the scientific and engineering processes produce reliable information and technologies
- The origins of the Earth, Moon, and life are well-researched and there is consensus as to how they arose by ordinary physical and chemical action
- Evidence-first methods work by experimentation, data collection, and the elimination of falsehood.
- Experimentation in earth science, particularly in astronomy, can seem difficult because of the sheer scope of the problems; innovation is often required to overcome such practical problems.
- Mathematics and physics provide important experimentation tools that overcome our fundamental human limitations (i.e. using the speed of light to measure distance or the behavior of soundwaves to map Earth's interior.)
- Aspects of Earth's structure make it a particularly hospitable place for life.
- Humanity is utterly insignificant on astronomical time, energy, and distance scales; and yet we are remarkable for having figured out so much with so little.
- Latitude and longitude are used to locate points on Earth, and a similar system is used to locate points in space.
- There is a deep connection among science and engineering. As telescope, spectroscope, and rocket technology has improved, new data has been collected that has informed an ever-sharper picture of the Universe.
- Diagrams can give a false impression of scale. The diameters of the Earth, Moon, and Sun are impossibly tiny in comparison to their orbits; i.e. the Solar System is mostly empty space.
- Day, night, the seasons, the eclipses, and the tides are all due to well-understood interactions among the Sun, Moon, and Earth.

Essential Questions

Unit Essential Questions

- What situations in ordinary life could benefit from investigation via the scientific method?

- What is the benefit of teaching students about the geocentric theory of the universe if we know it to be false?
- Why is science the best method for operating in and on the real world?
- How can we use evidence to process healthy skepticism, resolve scientific questions, and prevent the false equivalence of nonscientific ideas?
- How do we surmount the problems of distance, time, and the harsh conditions of space in order to study it?
- How do we deal with the distortions caused by the atmosphere?
- How do the Sun, Moon, and Earth interact to generate familiar phenomena?

Essential Question: A question that lies at the heart of a subject or a curriculum and one that promotes inquiry and the discovery of a subject.

- They can help students discover patterns in knowledge and solve problems.
- They support inductive teaching—guiding students to discover meaning, which increases motivation to learn.
- They are one of the most powerful tools for helping students think at more complex levels.
- They engage the personal intellect—something that traditional objectives usually fail to do.
- Have no obvious “right” answer •Raise other important questions, often across subject-area boundaries
- Address a concept
- Raise other important questions
- Naturally and appropriately recur
- Stimulate critical, ongoing rethinking
- Are framed to provoke and sustain student interest

What makes a Questions "Essential?"

- Continues throughout all our lives
- Refers to core ideas and inquiries within a discipline
- Helps students effectively ask questions and make sense of important and complex ideas, knowledge, and know-how
- Engages a specific and diverse set of learners

Two Types of Essential Questions:

- Overarching: The overall “Big Idea”
 - More general, broader •
 - Point beyond specific topics or skills
 - Promote the transfer of understanding •
- Topical: Unit or lesson specific but still promotes inquiry
 - Unit or lesson specific - used to guide individual units or lessons
 - Promote inquiry
 - Resist obvious answers
 - Require explanation and justification

Examples:

- What is a true friend?

- What makes an artist amazing?
- In what sense is the body a system?
- What is the law of nature, and how is it like or unlike social laws?
- To what extent is US history a history of progress?
- In what ways do diet and exercise affect health?
- Must heroes be flawless?
- How do effective writers hook and hold their readers?
- How do cultures affect one another?
- Does practice make perfect?
- What is healthy eating? Healthy living?
- How and when do we use mathematics?
- How does something acquire value?

Exit Skills

By the end of Unit 1 Students Should be able to:

- Know that the shape of the Earth is an oblate spheroid.
- Use evidence to attack false notions/misconceptions, such as that the Earth is six thousand years old or that it is flat.
- Reason with and be able to calculate using information about the mean diameter of the Earth and the height of the atmosphere (13 000 km and 12 km)
- Be able to use the latitude and longitude co-ordinate system
- Know the major divisions of Earth's internal structure and how they were formed
- Be able to use the major divisions of the Earth's surface as astronomical reference points, including: the Equator; the Tropics of Cancer and Capricorn; the Arctic Circle; the Antarctic Circle; the Prime Meridian; and the North and South Poles.
- Describe the effects of the Earth's atmosphere on astronomical observations, including sky color, skyglow (light pollution) and 'twinkling'
- Evaluate the necessity of space-based astronomy
- Use angular measures in degrees
- Know the shape of the Moon (that it too is an oblate spheroid, not crescent-shaped as it might sometimes appear)
- Reason with and be able to calculate using the mean diameter of the Moon (3500 km)
- Be able to recognise the appearance of the principal naked-eye lunar surface formations, including: craters; maria; terrae; mountains; and valleys
- Account for the processes that formed the principal lunar surface formations
- Be able to identify the following features on the lunar disc: the Sea of Tranquility; the Ocean of Storms; the Sea of Crises; Tycho; Copernicus; Kepler; the Apennine mountain range
- Be able to use the rotation and revolution (orbital) periods of the Earth and Moon
- Understand the synchronous nature of the Moon's orbit (tidal locking)

- translate information between graphical and numerical forms, for example when working with data on shadow lengths and directions from shadow sticks and sundials or on tides
- Be able to use the relative sizes-- and the distances among-- the Earth, Moon and Sun
- Understand how Eratosthenes and Aristarchus used observations of the Moon and Sun to determine successively: the diameter of the Earth; the diameter of the Moon; the distance to the Moon; the distance to the Sun; the diameter of the Sun
- Reason with and be able to calculate using the mean diameter of the Sun (1.4×10^6 km)
- Understand the relative effects of the Sun and Moon in producing high and low, spring and neap tides
- Understand the appearance of the Sun during partial, total and annular solar eclipses, including the terms first, second, third and fourth umbral contact
- Understand the causes of solar and lunar eclipses
- substitute numerical values into algebraic equations using appropriate physical quantities, for example in reproducing Eratosthenes' calculations
- Apply expressions in scientific notation; for example when considering the age of Earth or the actual size and relative scale of the Earth-Moon-Sun system
- Use ratios to determine the relative sizes of the Moon, Earth and Sun
- Use content-specialist units such as the AU and parsec
- Use degrees, minutes and seconds of arc
- Solve an algebraic expression for a desired variable
- Ensure consistency among physical units
- Substitute numerical values into algebraic equations using appropriate physical quantities
- Obtain needed astronomical/meteorological data for use in calculations e.g. tide tables
- Translate information between graphical and numerical forms, e.g. when working with data on shadow lengths and directions from shadow sticks and sundials or on tides

New Jersey Student Learning Standards (NJSL-S)

[NextGen Science Standards](#)

	interaction.
SCI.HS.PS3.C	Relationship Between Energy and Forces Cause and Effect Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show how relationships among variables between systems and their components in the natural and designed worlds.
SCI.HS-ESS1	Earth’s Place in the Universe Scale, Proportion, and Quantity Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Energy and Matter Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
SCI.HS.ESS1.C	The History of Planet Earth Patterns
SCI.HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth’s formation and early history.
SCI.HS.ESS1.C	The History of Planet Earth
SCI.HS.ESS2.A	Earth Materials and Systems
SCI.HS.PS4.A	Wave Properties
SCI.HS.ESS2.D	Weather and Climate
SCI.HS.ESS2.C	The Roles of Water in Earth’s Surface Processes
SCI.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth’s systems and life on Earth. Engaging in Argument from Evidence
SCI.HS.ESS2.E	Biogeology Stability and Change
SCI.HS.ESS3.B	Natural Hazards Cause and Effect Engaging in Argument from Evidence Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. Using Mathematics and Computational Thinking Stability and Change

Stability and Change

SCI.HS-ESS3-6

Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

SCI.HS.ESS2.D

Weather and Climate

SCI.HS.ESS3.D

Global Climate Change

Systems and System Models

Interdisciplinary Connections

Please list all and any additional **Interdisciplinary Connections/Cross-Curricular** New Jersey Student Learning Standards that link to this unit, and which are not included in the NJSLs section above.

MA.G-CO.A.1

Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

MA.G-CO.A.4

Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

MA.N-Q.A.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

MA.N-Q.A.2

Define appropriate quantities for the purpose of descriptive modeling.

LA.RI.11-12.1

Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.

LA.RST.11-12.8

Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

MA.N-VM.A.3

Solve problems involving velocity and other quantities that can be represented by vectors.

LA.WHST.11-12.1

Write arguments focused on discipline-specific content.

LA.WHST.11-12.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

LA.SL.11-12.4

Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience.

SOC.6.2.12.D.2.d

Analyze the impact of new intellectual, philosophical, and scientific ideas on how humans viewed themselves and how they viewed their physical and spiritual worlds.

SOC.6.2.12.CS2

Renaissance, Reformation, Scientific Revolution, and Enlightenment: Ideas developed during the Renaissance, Scientific Revolution, Reformation, and Enlightenment led to political, economic, and cultural changes that have had a lasting impact.

VPA.1.3.12.C.2

Create and evaluate performances by citing evidence of specific physical choices, sustained vocal technique, and clearly motivated actions.

Learning Objectives

Students will be able to..

- Construct a model that illustrates how our clocks and calendars are linked to astronomical events, including the Earth's rotation and orbit around the Sun.
- Given appropriate data, determine the distance to a given celestial object.
- Explain the significance and mechanism of Earth's internal magneto.
- Use Eratosthanes' observations to disqualify the flat-Earth model.
- Sketch and describe the basic designs of the major types of optical telescopes used by astronomers.
- Explain the advantages of computer image analysis, radio telescope, and enhancement in the collection of astronomical data.
- Describe how Earth's atmosphere affects astronomical observations, and discuss some of the current efforts to improve ground-based astronomy.
- Discuss the advantages and limitations of space-based astronomy.
- Describe the basic features of the Earth and Moon.
- Model the Earth-Moon system in a way that explains the tides and why we always see essentially the same face of the Moon.
- Model the Earth-Moon-Sun system in a way that explains solar and lunar eclipses and why the Sun and Moon appear to be the same size.
- Assess Earth's various astronomical/geological features in terms of their ability to support life.

Tips on Writing Good Learning Objectives

Bloom's Taxonomy

Applying Bloom's Taxonomy to Learning Objectives

Effective learning objectives need to be observable and/or measureable, and using action verbs is a way to achieve this. Verbs such as "identify", "argue," or "construct" are more measureable than vague or passive verbs such as "understand" or "be aware of". As you develop your syllabus focus on articulating clear learning objectives and then use these objectives to guide class assignments, exams and overall course assessment questions.

Sample Learning Objectives for a Lower Division Course

After completing Nutrition 101 *Humans and Food*, students will be able to: □

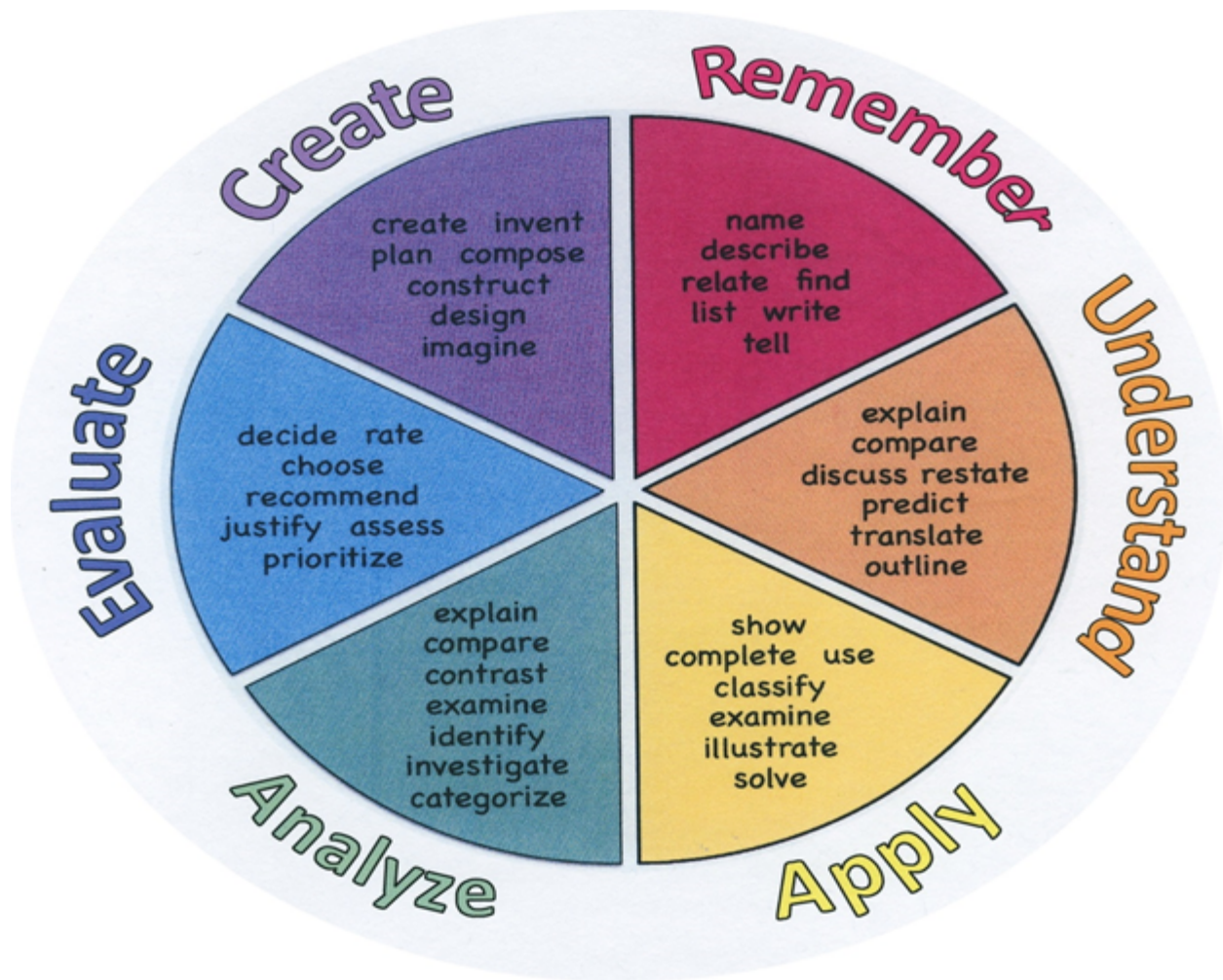
Identify nutrients found in common food sources via the product's nutrition label □

Use computer dietary analysis to assess a 2-day dietary intake and **summarize results** □ L

Locate nutrition-related information on the Internet and **use evaluative criteria** to **identify** reliability of the information

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

- What situations in ordinary life could benefit from investigation via the scientific method?
 - Construct an infographic or Foldable of the scientific method.
 - Short activity “What’s in the Black Box?”
 - Small group inquiry stations with real life situations, e.g. “What Doctors Do: Diagnosis: Why might this plant be sickly?”
- How can we use evidence to process healthy skepticism, resolve scientific questions, and prevent the false equivalence of nonscientific ideas?
 - Sketch/model a comparison of the flat earth and globe earth models to compare/contrast.
 - YouTube video describing heliocentric vs. geocentric, e.g. ”How We Know the Earth is Round: Facts to Share with Flat-Earthers”
 - Roleplay/instant debate of flat earth vs globe earth.
 - Infographic on radioactive dating and geological evidence contradict a young Earth
 - Short reading + questions/Think Pair Share on the flat Earth conspiracy and how we use evidence to debunk it

- Short reading/Do Now on the history of the atom as a callback to chemistry and evidence-based change in models
- What are the seven types of electromagnetic radiation? What physical properties do they have and how are they interrelated?
 - YouTube video on the properties of a wave.
 - YouTube video on the electromagnetic spectrum.
 - PhET simulation + worksheet, Waves and the Electromagnetic Spectrum
 - Construct an infographic identifying and showing the relationships among wavespeed, frequency, and wavelength.
 - Thought exercise: “How would you explain purple to a blind person?”
 - Construct a labeled diagram of the electromagnetic spectrum.
- Thousands of observations of the sky are made every night. What made Galileo’s observations uniquely important?
 - YouTube video on Galileo’s observations, e.g. “What Galileo Saw With His Telescope”
 - Thought exercise/Do Now: Crime scene: If this was an accident, what would we expect to see that isn’t here?”
 - Construct a presentation or informative video on the Galilean evidence
- How do we surmount the problems of distance, time, and the harsh conditions of space in order to study it?
 - YouTube video on how telescopes work, e.g. “Telescopes: Crash Course Astronomy #6”
 - YouTube video on distances, e.g. “Distances: Crash Course Astronomy #25”
 - Diagram the different types of telescopes and how they work.
 - Activity: “Build your own telescope” using magnifying glasses and cardboard tube.
- How do we deal with the distortions caused by the atmosphere?
 - YouTube video on GPS/weather satellites/spy satellites/communications satellites/ISS
 - NASA expose enhanced text article on the Hubble and James Webb telescopes

Assessment Evidence - Checking for Understanding (CFU)

- Common Benchmark Exam: Astronomy mp1 (Benchmark)

- Unit Test: Historical Astronomy (Summative)
- Unit Test: Intro to Astrophysics (Summative)
- Activity Worksheets/PhET Worksheets (Formative)
- Video Active Notes (Formative)
- NearPod In-Class Multiple Choice (Formative)
- NearPod Class Post-It Brainstorm Board (Formative)
- Infographic Rubrics (Alternate)
- Informative Video Rubric (Alternate)
- Presentation Rubrics (Alternate)
- Quiz: Parts of the Scientific Method (Summative)
- Quiz: Determining Distance (Summative)
- Quiz: Determining Chemical Composition (Summative)
- Quiz: Determining Motion (Summative)
- Quiz: Electromagnetic Spectrum (SUMmative)
- Think, Pair, Share on the scientific and orthodox perspectives (Formative)
- 3D Model Rubric (Alternate)

By identifying the **Evidence of Student Learning with Checking for Understanding (CFU)** techniques used during the lesson and/or for Closure (Madeline Hunter), please list the variety of means used to assess students' learning (e.g. quizzes, tests, academic prompts, observations, homework, journals).

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems

- Quickwrite
- Quizzes
- Self- assessments
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Class Text: Bennett, J. O., M Donahue, Schneider, N., & Voit, M. (2020). The cosmic perspective. Pearson Education, Inc.

Ancillary Resources

YouTube videos, *e.g.*:

- How We Figured Out That Earth Goes Around the Sun: <https://www.youtube.com/watch?v=khIzr6610cQ>
- How Do Telescopes Work? <https://www.youtube.com/watch?v=5v7bN13PjZ8>
- Distances: Crash Course Astronomy #25 <https://www.youtube.com/watch?v=CWMh61yutjU&list=PL8dPuuaLjXtPAJr1ysd5yGIyiSFuh0mIL&index=25>
- Telescopes: Crash Course Astronomy #6 <https://www.youtube.com/watch?v=mYhy7eaazIk&list=PL8dPuuaLjXtPAJr1ysd5yGIyiSFuh0mIL&index=6>
- What Galileo Saw With His Telescope <https://www.youtube.com/watch?v=bCIEYUeXlI8&t=574s>
- What is Hubble? <https://www.youtube.com/watch?v=FEqDEPsBHQ>
- It Can See the First Galaxies! The James Webb Telescope <https://www.youtube.com/watch?v=cXGJNAz1p3E>
- What is the International Space Station? <https://www.youtube.com/watch?v=5gTm1cHC-b8>
- How does the International Space Station work? https://www.youtube.com/watch?v=oLrOnEmy_GA
- How does GPS Work? https://www.youtube.com/watch?v=FU_pY2sTwTA

Interactives

- PhET Electromagnetic Spectrum: <https://phet.colorado.edu/en/contributions/view/3154>

Websites

- Bad Astronomy, via the NSF: <http://www.badastronomy.com/bad/misc/index.html>
- the Physics Classroom: <http://www.thephysicsclassroom.com>
- Phys.org: <http://www.phys.org>
- Space.com, specifically: <https://www.space.com/15589-galileo-galilei.html>
- Nasa.gov, specifically: <https://solarsystem.nasa.gov/news/307/galileos-observations-of-the-moon-jupiter-venus-and-the-sun/>

YouTube Channels

- CrashCourse Astronomy
- Spacetime
- National Geographic
- SciShow Space
- Arvin Ash
- BBC Earth Lab
- SciBRIGHT
- How the Universe Works
- NASA
- Science Channel
- Vsauce
- Kurzgesagt
- AsapSCIENCE
- Beyond Science
- The Action Lab

Ancillary Text:

- Gray, T., & Haynes, J., (2017). GCSE Astronomy. CreateSpace Independent Publishing Platform.

LGBTQIA+ in the Curriculum:

- The story of Dr. Frank Kameny, Harvard graduate, WWII veteran, and astronomer for the US Map Service; who was terminated on the grounds that his sexuality was an "inappropriate security risk" and who became a critical LGBT rights activist and promoter of LGBT equality. His research is topical to this unit because it was targeted at establishing distances in space.
 - Relevant Wikipedia article as a jumping-off point: https://en.wikipedia.org/wiki/Frank_Kameny
 - Short primer/facts video: <https://www.youtube.com/watch?v=pfPsiBgew18>

Please list all additional resources that will be used to strengthen this unit's lessons.

Technology Infusion

- Schoology Interactive Discussion (Groups)
- Newsela
- PhET through the University of Colorado
- Google Suite
- Nearpod
- Universe Sandbox
- YouTube
- EdPuzzle
- FlipBoard

What **Technology Infusion** and/or strategies are integrated into this unit to enhance learning? Please list all hardware, software and strategies. Please find a technology pedagogy wheel for assistance while completing this section.

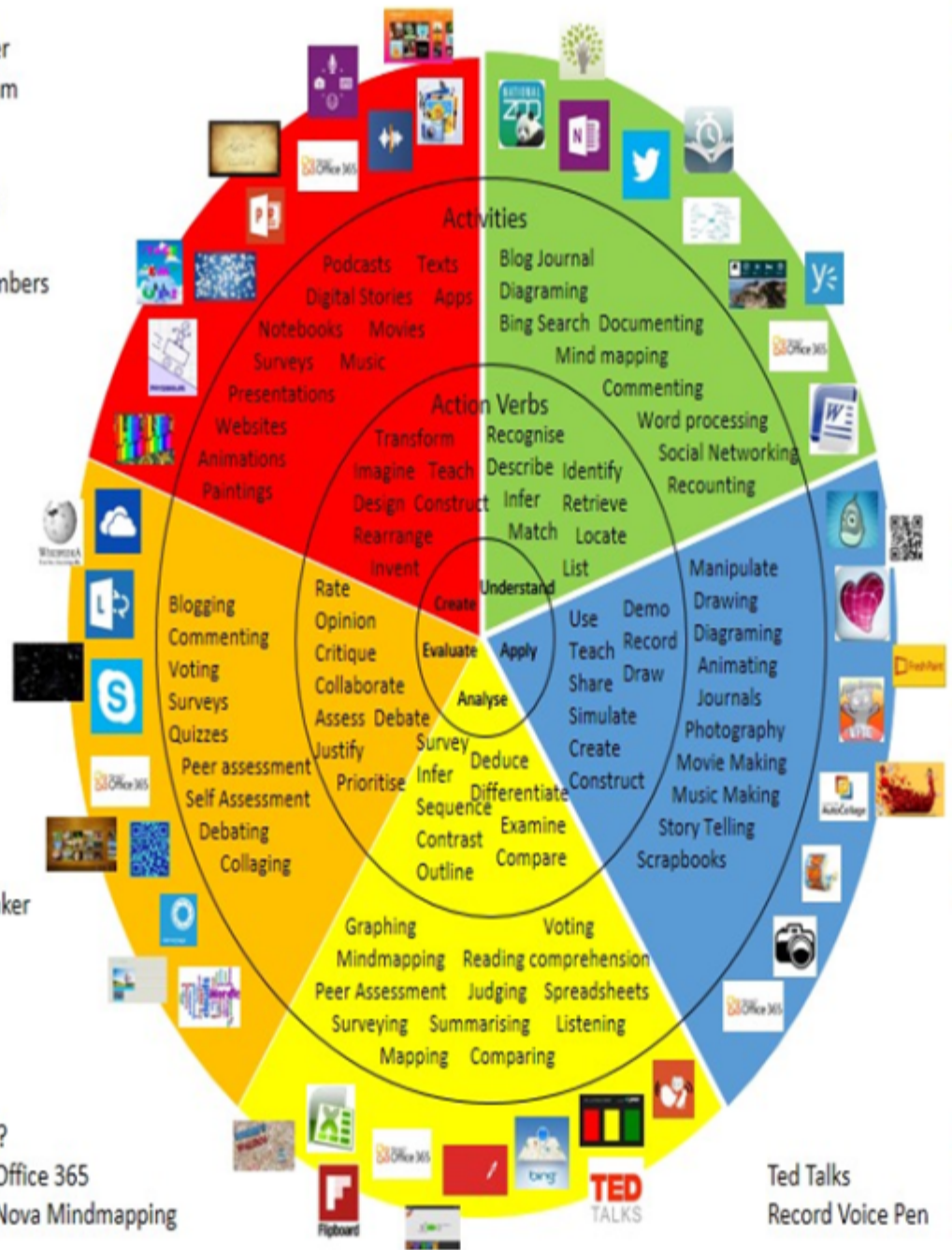
Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
 Photostory 3
 Kid Story Builder
 Music Maker Jam
 Paint A Story
 Office 365
 MS PowerPoint
 Stack 'Em Up
 NqSquared Numbers
 Physamajig
 Xylophone 8

Wikipedia
 Skydrive
 Lync
 SkyMap
 Skype
 Office 365
 Puzzle Touch
 Easy QR
 Memorylage
 Life Moments
 Word Cloud Maker

Where's Waldo?
 MS Excel
 Flipboard
 Office 365
 Nova Mindmapping

Ted Talks
 Record Voice Pen



Originally taken from <http://www.coetail.com/vzimmer/files/2013/02/IPadagogy-Wheel.001.jpg>
 And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

WRK.9.1.2.CAP.2	Explain why employers are willing to pay individuals to work.
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.1.12.F.CS4	Use multiple processes and diverse perspectives to explore alternative solutions.
TECH.8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world. Different types of jobs require different knowledge and skills.

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements,

	costs, loans, and debt repayment.
WRK.9.2.12.CAP.13	Analyze how the economic, social, and political conditions of a time period can affect the labor market.
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
	Securing an income involve an understanding of the costs and time in preparing for a career field, interview and negotiation skills, job searches, resume development, prior experience, and vesting and retirement plans.

21st Century Skills/Interdisciplinary Themes

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- Civic Literacy
- Communication and Collaboration
- Environmental Literacy
- Global Awareness
- ICT (Information, Communications and Technology) Literacy

21st Century Skills

Please list only the **21st Century Skills** that will be incorporated into this unit.

- Communication and Collaboration
- Creativity and Innovation
- Critical Thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

Differentiation

Please identify the ones that will be employed in this unit.

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Study guides
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Tiered activities/assignments
- Tiered products

Lo-Prep Differentiations

- Choice of books or activities
- Exploration by interest

- Flexible grouping
- Goal setting with students
- Mini workshops to re-teach or extend skills
- Think-Pair-Share
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Recommendations for these populations are found in the individual student's 504 plan or IEP.

Some strategies that work well in this unit/can be applied to this unit include:

- printed copy of board work/notes provided
- ask student to rephrase or repeat directions; or to give directions to another student
- assistive technology
- calculation guides
- check work frequently for understanding
- checklisting and/or chunking
- computer or electronic device utilizes
- exemplars and modeling of procedures
- extended time on tests/ quizzes
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- Reduced overall workload, especially through choice boarding
- Reduction of choices (for students with cognitive overload issues)
- Reduction of choices (for students with cognitive overload issues)

- repeated and/or multimodal instructions and directions
- shortened assignments
- tiering of assignments for students with different course goals
- Triangle or partner system
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Strategies around ELL should be directed at either leveraging content to build language skill, or supporting (through translated materials, for example) the developing language skill to learn new content; balancing these things is important. The students' ELL teachers are a valuable resource when considering what activities might be best with particular students.

- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or translation tools/open-book during assessment
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- multi-modal instruction and directions
- providing study guides and teacher notes
- reducing or omitting lengthy outside reading assignments
- reducing overall workload to account for time lost in language processing
- reducing the number of answer choices on a multiple choice test
- triangle or partner system
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes

- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Earth, Moon, and Sun

This lesson will introduce heliocentric and geocentric models of the solar system. The presentation will go through some of the greatest thinkers and their contributions to each model. This includes a presentation, and a foldable template for students to link the contributors to the model and their input.

Interdisciplinary Connection: SOC.6.2.12.CS2 ; SOC.6.2.12.D.2.d

Statement of Objective: Students will be able to evaluate the heliocentric and geocentric models of the solar system. Students will be able to use evidence to defend the heliocentric model of the solar system.

Anticipatory Set/Do Now: As organized by Nearpod, students will watch a ten-minute Prezi presentation entitled “Who Was Right?”, supported by a pen-and-paper graphic organizer to help frame their thoughts. The support provided by the organizer varies by student ability, especially for ELL students.

Learning Activity: Whole-class collaborative construction of a Venn diagram using Nearpod + an online Venn generator + the Smart TV. Briefly review the major aspects of Venn diagrams during this process. References to formal set theory for G&T. Correct student misconceptions during this process. Most common misconception is drawing the circles first, which makes the diagram difficult to read or use.

Paired construction of an infographic or Foldable: Using construction paper and various other art supplies, student Triangle groups should construct an infographic or Foldable with which they can later use to instruct a family member or friend who does not take Astronomy. The group should also construct a short assessment, i.e. a two-question quiz either on paper or by using Google Forms, that they can administer to the person they’ve taught. The student should correct the assessment before submitting it for evaluation.

Student Assessment/CFU's: Teacher review via Nearpod of student Do Now responses. Teacher observation and cold-call, perhaps with index cards, speak-for-the group, or individual whiteboards during the learning activity. Evaluation of the infographic or Foldable student product using a relevant rubric; evaluation of the students’ peer teaching results by looking at the corrected version of the student-designed assessment.

Materials: Various art supplies, student Chromebooks, grouping furniture, class printer, SmartTV or whiteboard.

21st Century Themes and Skills: Communication and Collaboration, Creativity and Innovation, and Critical Thinking and Problem Solving.

Differentiation/Modifications: ELL: Provide relevant words (bubbles) for the graphic organizer and focus instead on how the terms are related (stems); preferential pairing with a non-ELL student; use a word wall to review pronunciation. At-risk students: study guides/guided notes rather than/in addition to the graphic organizer; peer teaching instead of sending the assessment home; use of the student’s Foldable or infographic during testing. G&T: Select students could perform as the key figures in the geocentric vs heliocentric argument rather than using the introductory video; if this option is selected, plan for the lesson to go over more than one day. Handout with formal set-theory description of Venn diagrams. An alternative assessment could be of much higher-order thinking, such as: “A theory begins to circulate about the Internet that the Earth is in fact flat. How could you use the evidence in this lesson to falsify this theory?”

Integration of Technology: student Chromebooks; Prezi automated cloud presentation software; Venn diagram generator; Nearpod; Google Earth; SmartTV.

