Richmond Public Schools

Department of Curriculum and Instruction

Curriculum Pacing And Resource Guide – Unit Plan

Course Title/ Course #: Astronomy, Space exploration

Unit Title/ Marking Period # (MP 4): Scientific Investigation and the Nature of Science, Space exploration AS.1, AS.6

Start day:

Meetings (Length of Unit):

Desired Results ~ What will students be learning?

Standards of Learning/ Standards

AS. 1

The student will apply inquiry-based and problem-solving processes and skills to scientific investigations. Key concepts include

a) describe the scientific method and the role of critical thinking in science.
b) differentiate among the scientific facts, laws (principles), hypotheses, and theories.
c) contrast the scientific use of the word "theory" with its more popular uses.
d) identify pseudo-sciences (e.g. astrology) and describe their lack of valid hypothesis testing.
e) discuss how other approaches to understanding our world (e.g. Art, Philosophy, Theology) complement, rather than contradict, the scientific approach.

AS. 6

The student will research and summarize space travel and exploration. Key concepts include

a) Mercury Program
b) Apollo Program
c) Sky Lab
d) Space Shuttle
e) International Space Station
f) Unmanned Space Programs
g) Possible Future Missions

Essential Understandings/ Big Ideas

AS.1

- The concepts developed in this standard include the following:
- The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world.
  The nature of science includes the concepts
- the natural world is understandable;
- science is based on evidence - both observational and experimental;
- science is a blend of logic and innovation;
- scientific ideas are durable yet subject to change as new data are collected;
- science is a complex social endeavor; and
- scientists try to remain objective and engage in peer review to help avoid bias.
- Earth is a dynamic system, and all atmospheric, lithospheric, and hydrospheric processes interrelate and influence one another.
- A hypothesis is a tentative explanation that accounts for a set of facts and can be tested by further investigation. Only hypotheses that are testable are valid. A hypothesis can be supported, modified, or rejected based on collected data. Experiments are designed to test hypotheses.
- Scientific theories are systematic sets of concepts that offer explanations for observed patterns in nature. Theories provide frameworks for relating data and guiding future research. Theories may change as new data become available. Any valid scientific theory has passed tests designed to invalidate it. Changing relevant variables will generally change the outcome.
- Scientific laws are generalizations of observational data that describe patterns and relationships. Laws may change as new data become available.

AS.6

- Project Mercury was the first human spaceflight program of the United States, running from 1958 through 1963. An early highlight of the Space Race, its goal was to put a man into Earth orbit and return him safely, ideally before the Soviet Union.
- The Apollo program was designed to land humans on the Moon and bring them safely back to Earth
- **Skylab** was the first space station operated by the United States.
- A space shuttle is a rocket-launched spacecraft, able to land like an unpowered aircraft, used to make repeated journeys between the earth and earth orbit.
- The **International Space Station** is a large spacecraft in orbit around Earth. It serves as a home where crews of astronauts and cosmonauts live. The **space station** is also a unique science laboratory. Several nations worked together to build and use the **space station**.
- Over 1,000 unmanned missions have been sent into space to explore our solar system. NASA has launched both exploration and communication satellites into orbit

Key Essential Skills and Knowledge

AS.1

In order to meet this standard, it is expected that students will

- analyze how natural processes explain multiple aspects of Earth systems and their interactions (e.g., storms, earthquakes, volcanic
- make predictions, using scientific data and data analysis.
- use data to support or reject a hypothesis.
- differentiate between systematically-obtained, verifiable data and unfounded claims.
- evaluate statements to determine if systematic science is used correctly, consistently, thoroughly, and in the proper context.
- distinguish between examples of observations and inferences.
- explain how scientific methodology is used to support, refute, or improve scientific theories.
- contrast the formal, scientific use of the term "theory" with the everyday nontechnical usage of "theory."
- compare and contrast hypotheses, theories, and scientific laws.

AS.6

In order to meet this standard, it is expected that students will

- identify and explain the contributions of human space flight and future plans and challenges
- recognize the advancement of knowledge in astronomy through robotic space flight
- analyze the importance of ground-based technology in astronomical studies
- recognize the importance of space telescopes to the collection of astronomical data across the electromagnetic spectrum
- demonstrate an awareness of new developments and discoveries in astronomy.

Vocabulary

conclusion hypotheses reasoning predicts
theories observation inference theory
Zenith
Horizon

asteroids cosmology nebulae stellar black hole
Big Bang galaxies nebular stellar evolution
comets meteors planet sun
constellations moons star systems

Assessment Evidence ~ What is evidence of mastery? What did the students master & what are they missing?

Assessment/ Evidence

Evidence of mastery: Students will display mastery by consistently scoring at a "C" or above on all assessements. Success and mastery will also be shown by increasing scores from the beginning of the unit to the end of the unit. Overall mastery of the content and targeted objectives will be assessed during final unit assessment.

Assessment Methods:

- Teacher created IA Test/Quiz
- Group Discussions
- Predict and Explain Assessments- students apply principles and evidence
- Research Reports & Presentations
- Visual Displays- Concept maps, Diagrams, Models

Possible learning Gaps/Misconceptions

AS.1

- Vocabulary
- Science concept application
- Understanding the Limits of Science
- Identifying variables
- Recording and Analyzing Data
- Science is a collection of facts
- There is a single Scientific Method that all scientists follow.

AS.6

- Astronomy Vocabulary
- The Sun is not a star.
- The Sun disappears at night.
- The Sun will never burn out.
- The surface of the Sun is without visible features.
- The Sun rises exactly in the east and sets exactly in the west every day.
- The Sun is always directly south at 12:00 noon.
- The tip of a shadow always moves along an east-west line.
- The amount of daylight increases each day of summer.
- We experience seasons because of Earth's changing distance from the Sun–––closer in summer, farther in winter.
- The Earth is the largest object in the solar system. It is larger than the Sun.

Learning Plan ~ What are the strategies and activities you plan to use

Learning Experiences/ Best Practice

AS.1

- Have students to analyze how natural processes explain multiple aspects of Earth systems and their interactions (e.g., storms, earthquakes, volcanic eruptions, floods, climate, mountain chains and landforms, geological formations and stratigraphy, fossils) can be used to make predictions of future interactions and allow scientific explanations for what has happened in the past.
- Have student to make predictions, using scientific data and data analysis.
- Have students to use data to support or reject a hypothesis.
- Have student to differentiate between systematically-obtained, verifiable data and unfounded claims.
- Have student to evaluate statements to determine if systematic science is used correctly, consistently, thoroughly, and in the proper context.
- Have student to distinguish between examples of observations and inferences.
- Have student to explain how scientific methodology is used to support, refute, or improve scientific theories.
- Have students to contrast the formal, scientific use of the term "theory" with the everyday nontechnical usage of "theory."
- Have students to compare and contrast hypotheses, theories, and scientific laws.
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AS.6

- Have students identify and explain the contributions of human space flight and future plans and challenges
- Have students recognize the advancement of knowledge in astronomy through robotic space flight
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- Have students recognize the importance of space telescopes to the collection of astronomical data across the electromagnetic spectrum
- Have students demonstrate an awareness of new developments and discoveries in astronomy.

Technology Integrations

Web Resources

Resources for Teaching High School Astronomy **http://outreach.as.utexas.edu/marykay/highschool/hs.html**

Online Astronomy Resources **http://www.skyandtelescope.com/online-resources/**

http://www.nasa.gov/

http://www.heavens-above.com/

http://www.kidsastronomy.com/

YouTube
Scientific Investigation
Scientific graphing measurement
Scientific Method

Resources

Sample lesson plans (VDOE)
Scientific Investigation Analyzing Your School Quadrangle

Cross Curricular Connection

English- Students use rubric to write lab reports
Math- Students calculate mean, median, mode
Math- Students construct line/bar graphs, pie charts
English- make science come to life with biographies of great astronomers or true stories about their discoveries.