Richmond Public Schools

Department of Curriculum and Instruction

Curriculum Pacing And Resource Guide – Unit Plan

Course Title/ Course #: Earth Science I

Unit Title/ Marking Period # (MP): Scientific Investigation and the Nature of Science ES.1a-f , ES.2a-d

Start day:

Meetings (Length of Unit):

Desired Results ~ What will students be learning?

Standards of Learning/ Standards

ES.1 The student will plan and conduct investigations in which
a) volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools;
b) technologies, including computers, probeware, and geospatial technologies, are used to collect, analyze, and report data and to demonstrateconcepts and simulate experimental conditions;
c) scales, diagrams, charts, graphs, tables, imagery, models, and profiles are constructed and interpreted;
d) maps and globes are read and interpreted, including location by latitude and longitude;
e) variables are manipulated with repeated trials; and
f) current applications are used to reinforce Earth science concepts.

ES.2 The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include
a) science explains and predicts the interactions and dynamics of complex Earth systems;
b) evidence is required to evaluate hypotheses and explanations;
c) observation and logic are essential for reaching a conclusion; and
d) evidence is evaluated for scientific theories.

Essential Understandings/ Big Ideas

ES.1

The concepts developed in this standard include the following:

 Density expresses the relationship between mass and volume.

 Information and data collected can be organized and expressed in the form of charts, graphs, and diagrams.

 Scale relates to actual distance.

 Topographic maps and satellite imagery are two-dimensional models that provide information defining three-dimensional landforms. They contain extensive information related to geographic as well as human structures and changes to the land surface, and are useful in understanding geologic processes.

 Grid systems of latitude and longitude are used to define locations and directions on maps, globes, and charts.

ES.2

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

a) the natural world is understandable;

b) science is based on evidence - both observational and experimental;

c) science is a blend of logic and innovation;

d) scientific ideas are durable yet subject to change as new data are collected;

e) science is a complex social endeavor; and

f) 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.

Key Essential Skills and Knowledge

ES.1

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

 measure mass and volume of regular and irregular shaped objects and materials using common laboratory tools, including metric scales and graduated cylinders.

 apply the concept of mass per unit volume and calculate density without being given a formula.

 record data in systematic, properly-labeled, multi-cell tables, and using data, construct and interpret continuous line graphs,

frequency distributions, bar graphs, and other explicating graphics that present a range of parameters, relationships, and pathways.
 interpret data from a graph or table that shows changes in temperature or pressure with depth or altitude.
 interpret landforms, water features, map scale, horizontal distance between points, elevation and elevation changes, latitude and longitude, human-made structures and other pertinent features on 7.5 minute quadrangles on topographic maps.
 construct profiles from topographic contours.
 use latitude and longitude down to minutes, with correct north-south and east-west designations, to locate points on a map.

ES.2

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 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.
 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. For example, students should be able to compare/contrast the Law of Superposition and the Theory of Plate Tectonics.

Vocabulary

ES.1

analyze	area	charts	data	density
diagrams	direction	distance	elapsed time	elevation
graphs	maps	mass	pressure	scales
tables	temperature	variable	volume	latitude
longitude	contour	topographic map	profile	index contours

ES.2

conclusion	hypotheses	reasoning	predicts
theories	observation	inference	theory

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

- Vocabulary
- Science concept application
- Understanding the Limits of Science
- Identifying variables
- Recording and Analyzing Data
- "An object, such as a boat, floats because water is pushing up on it."
- "The weight of an object determines if it will sink or float. Heavy objects always sink, and light objects always float."
- "Objects with holes in it will sink. Except for a sponge. That's the only exception."
- "The smaller something is, the less density it has. So smaller objects are less dense than larger objects."
- "If you cut a piece of wood in half, the density of each piece is now half of the original piece."
- "Density is the thickness of something. Chocolate syrup is very dense because it's so thick and takes time to pour."
- "Oil weighs less than water. That's why when an oil spill occurs, the oil floats on top of the water."
- "Wood and plastic objects float. Metal objects sink."
- "If you take a ball of clay and add more clay to it, the ball will get larger and the density will increase."
- Science is a collection of facts
- There is a single Scientific Method that all scientist follow.
- Map landforms are true in shape and size.
- Calculating and understanding map distance

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

Learning Experiences/ Best Practice

- 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."
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Technology Integrations

Web Resources

The Floating Cans Lab
Measuring density of liquids
Water displacement (includes overflow cup instructions)
Using a graduated cylinder
Using a graduated cylinder II
Ruler and graduated cylinder practice
Ruler and graduated cylinder practice
Water displacement
Solids
Reading triple beam balances
Triple beam balances
Mass vs. weight
Ruler levers
Topographic maps
Topographic map lab
Building a topographic model

YouTube
Scientific Investigation
Scientific graphing measurement
Mapping
Scientific Method

Resources

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

Cross Curricular Connection

English- Have each student write a short description of various maps, using key vocabulary, including map essentials. Have students share their descriptions orally with the class.
English- Students use rubric to write lab reports
Math- Students calculate mean, median, mode
Math- Students construct line/bar graphs, pie charts