# Topic 1 – Science Skills

## Vocabulary

**Classification** – Grouping together based on similar observable characteristics.

**Cyclic change** – A predictable change in the environment that is predictable.

**Density** – The mass of matter in a solid, liquid or gas to the ration of the volume – mass per unit volume.

**Dynamic equilibrium** – A condition of balancing opposing forces or actions. Such as evaporation and condensation or erosion and deposition.

**Inference** – An interpretation of an observation, a mental process that proposes causes, conclusions, and / or explanations for what has been observed.

**Instrument** – A device used to extend the sense foe accurate measurements.

**Interface** – A boundary between regions or substance with different properties where energy can still be exchanged, for example, atmosphere and hydrosphere or troposphere and stratosphere.

**Mass** – The amount of matter in an object.

**Natural hazard** – A non-made made situation or event causing damage, loss to life and / or property.

**Natural resources** – Materials used by humans in their daily lives.

**Observation** – Use of the five senses to perceive the environment; used to gather data based on observable characteristics.

**Percent Deviation** – The amount the measured value varies from the actual value.

**Pollution** – Any substance that is in high concentrations in the environment that pollute and can cause damage.

**Prediction** – Determining the condition about the future of the environment based on observations or inferences.

**Rate of change** – A measurable change in the environment compared to a unit of time. For example: miles / hour or km / sec.

**Universe** – all existing matter and space considered as a whole; the cosmos.

**Volume** – The amount of space a substance occupies.

# Overview of Topic

**EARTH SCIENCE is:**

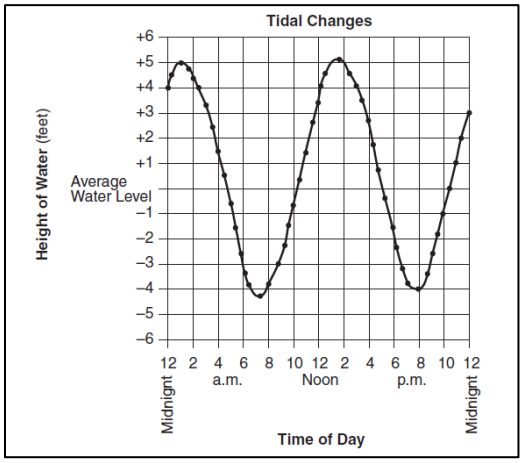
- Geology: study of Earth's History, structure, processes, and composition of Earth from the surface to the core.
- Astronomy: Study of Earth in the Solar system and the universe, which is all time, matter, energy and space.
- Meteorology: Study the Earth's atmosphere and its influence on weather climate.
- Oceanography: Study of the Earth's oceans.

I. Observations
   a. Uses the five senses
   b. Use instruments to measure
   c. Inferences
      i. Interprets observations
   d. Classification
      i. Groups objects from observation will similar characteristics
   e. Measurement - Metric
      i. Length – distance between two points.
         - Meters (m)
         - Centimeters (cm)
      ii. Mass – amount of matter in an abject, the atoms or molecules that make up the substance.
         - Kilograms (kg)
         - Grams (g)
      iii. Volume – the amount of space a substance occupies.
         - Cubic centimeters ($cm^3$) for solids
         - Milliliters (ml) for liquids
      iv. Time – the duration of an event.
         - Hours (hrs)
         - Minutes (min)
         - Seconds (sec)

II. Density
   a. Concentration of matter in a substance.
   b. Formula pg. 1 of ESRT
   c. More dense objects sink in less dense objects.
      i. Solids can float in a liquid due to density.

III. Changing Environment
   a. Rate of change
      i. Formula pg. 1 of ESRT

b. Cyclic change
    i. The event repeats
        - Phases of the moon
        - Tides
        - Rising setting of the sun

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c. Predicting change
    i. Based on cyclic events
    ii. When next minimum or maximum occurs.
        - Sunspots
        - Tides
        - Full moon

IV. Humans in the Environment
    a. Natural resources
        i. Air
        ii. Water
        iii. Minerals
        iv. Fossil fuels

    b. Pollution
        i. Causes
            - Often focus is on the greenhouse gasses.
                - Carbon dioxide – $CO_2$
                - Methane – $CH_4$
                - Water vapor – $H_2O$

# Earth Science Reference Table – (ESRT)

Pages from ESRT used in Topic 1.

***Page 1***

Properties of water

## Properties of Water

| | |
|---|---|
| Heat energy gained during melting | 334 J/g |
| Heat energy released during freezing | 334 J/g |
| Heat energy gained during vaporization | 2260 J/g |
| Heat energy released during condensation | 2260 J/g |
| Density at 3.98°C | 1.0 g/mL |

Most dense

This information will be used during the course of the year.

The pages below and the formulas are used commonly with science skills throughout the entire earth Science curriculum.

Look for the box labeled equations.

## Equations

$$\text{Eccentricity} = \frac{\text{distance between foci}}{\text{length of major axis}}$$

$$\text{Gradient} = \frac{\text{change in field value}}{\text{distance}}$$

$$\text{Rate of change} = \frac{\text{change in value}}{\text{time}}$$

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

These equations

These equations are important to make accurate and precise relationships based on measurements.

The equations are broken down to demonstrate how they work below.

## *Density*

Density is a very common theme in Earth Science. It affects air circulation patterns, ocean currents, magma in Earth's crust. Density is affected by temperature, in most cases as temperature decreases the density of a substance increases.

Density can be calculated using the formula: $Density = \frac{mass}{volume}$. Units of density are typically using the following units: $\frac{grams}{mL}$ $or$ $\frac{grams}{cm^3}$.

The unit of volume milliliters (mL) is used when measuring a liquid, the unit cubic centimeter ($cm^3$) is for solid object.

Problems can be set up a variety of ways. They should write the formula and show work.

*Example 1:* A student finds a mineral and calculates the mass to be 12.7 grams and the volume to be 5.3 $cm^3$. What is the calculated density?

*Density =* $\frac{mass}{volume}$

*Density =* $\frac{12.7\ g}{5.3\ \ cm^3}$ *= 2.39* $\frac{g}{cm^3}$. Round the answer to the nearest tenth. **2.4** $\boldsymbol{\frac{g}{cm^3}}$

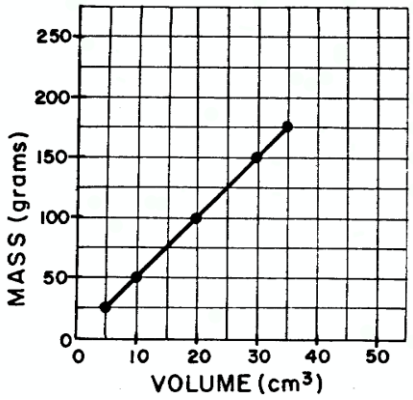
*Example 2:* The mass of an unknown liquid is determined to be 125.1 g and the volume was determined to be 132.0 mL. What is the density of the unknown liquid?

Just in the problem above you will use the formula the same way, the units will be slightly different.

*Density =* $\frac{mass}{volume}$

*Density =* $\frac{125.1\ g}{132.0\ mL}$ = 0.94 $\frac{g}{mL}$, when rounded to the nearest tenth. **0.9** $\boldsymbol{\frac{g}{mL}}$

*Example 3:* Use the graph below to find the density of the substance.




Choose a point on the graph and write it components.

Mass = **100 g** Volume = **20 cm$^3$**

*Density* = $\frac{mass}{volume}$

*Density* = $\frac{100\ g}{20\ cm^3}$ = *5.0*$\frac{g}{cm^3}$. Round the answer to the nearest tenth. **5.0** $\frac{g}{cm^3}$

In this example you can use any points on the line, if the line is straight.

## *Rate of change*

The ***Rate of change*** formula requires students to use units in their answers. On the Regents and in many cases classroom activities it is important to show answers with the correct units to receive credit.

Units based on what the problem, in most cases a graph data table, is presenting.

Examples of units reported. $\frac{miles}{hr}$, $\frac{km}{hr}$. $\frac{^0C}{hr}$. These are not the only units. Student must pay attention to the map and scale that is accompanied. Below is an example of a graph with implied and measurable units.

| Time (P.M.) | Rock Temperature (°C) |
|---|---|
| 2:10 | 30 |
| 2:11 | 33 |
| 2:12 | 38 |
| 2:13 | 40 |
| 2:14 | 41 |
| 2:15 | 42 |
| 2:16 | 43 |
| 2:17 | 43 |
| 2:18 | 43 |

A problem can be presented this way.

What is rate of temperature change from 2:10 to 2:16 P.M.?

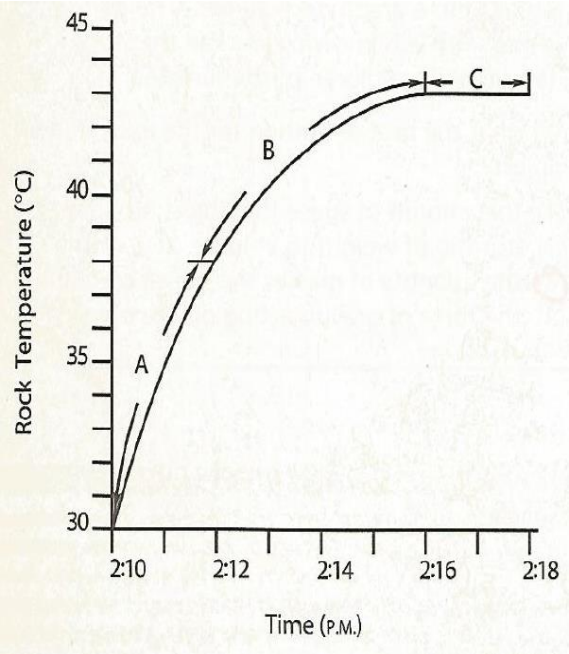
Write the formula even if they don't like to.

$$\text{Rate of change} = \frac{\text{change in value}}{\text{time}}$$

You don't need to include the hours in the time because it doesn't change, instead focus on the change in minutes.

$$\text{Rate of change} = \frac{(43-30)^0C}{6\ minutes} = \frac{13\ ^\circ C}{6\ min} = \mathbf{2.2}\ \frac{^\circ \boldsymbol{C}}{\boldsymbol{min}}$$

Answer should be in simplest form. Encourage students not to report beyond the tenths unless asked.




The problem can also be presented with a graph.

For example: What is the rate of temperature change during the heating of the rock during time B.

Pick the times and the temperature of the graph.

Follow the procedure above.

Hints to getting the most credit.

1) Write the formula on your calculations or scrap sheet.

2) Show work with units in problem even if it is not comfortable.

3) Answer can be to a whole number. If they calculate a decimal round to nearest tenth unless told otherwise.