Name: **Key**

Introduction to Earth Science NOTES

OBJECTIVES

Correctly define: observation, inference, classification, percent deviation, density, rate of change, cyclic change, dynamic equilibrium, interface, mass, volume

GRAPHICAL RELATIONSHIPS

- Graphically demonstrate the difference between direct, inverse, cyclic, and non- relationships.
- Classify events as cyclic or non-cyclic.
- Associate the words "cyclic" and "predictable".

OBSERVATIONS, INFERENCES AND CLASSIFICATION

- Give an example of an observation.
- Develop an inference based on collected data.
- Classify objects based on their similarities or differences.

DENSITY, MASS, VOLUME

- Explain how density, mass and volume change as an object is heated, cooled or split apart.
- Calculate the density of regularly shaped and irregularly-shaped objects.
- Graphically show the relationship between temperature and density for: (1) water (2) all other objects
- State the temperature at which water is most dense and whether a object will sink or float in water based on its density.
- State the phase of matter in which most materials are most and least dense.

SCIENTIFIC INSTRUMENTS

- State the most common instruments used to measure the: (1) volume of regular, rectangular objects, (2) volume of irregularly shaped objects, (3) mass of objects, (4) distance between objects, and (5) time.

REAL-WORLD EXAMPLES

- Give real-life examples of a system in dynamic equilibrium, an interface, and three cyclic events.

FORMULAS AND WORD PROBLEMS

- Mathematically solve volume, density, percent deviation, and rate of change problems using the Earth Science Reference Tables.

Vocabulary

Classification: _____

_____

Cyclic Change: _____

_____

Density: _____

_____

Dynamic Equilibrium: _____

_____

Inference: _____

_____

Interface: _____

_____

Mass: _____

_____

Observation: _____

_____

Percent deviation: _____

_____

Rate of Change: _____

_____

Volume: _____

_____

Key Concepts & Questions

Scientific Instruments

	Common Instrument
Volume of Regular, Rectangular Objects (a box)	ruler
Volume of Irregularly Shaped Objects (rocks)	graduated cylinder
Mass	scale, triple beam balance
Distance	ruler
Time	stopwatch

Formulas

Using the Earth Science Reference Tables, write the formula for each of the items below:

density: $\text{density} = \frac{\text{mass}}{\text{volume}}$

percent error (deviation): $\text{deviation (\%)} = \frac{\text{difference from accepted value}}{\text{accepted value}} \times 100$

rate of change: $\text{rate of change} = \frac{\text{change in field value}}{\text{time}}$

Accuracy

What does it mean if you are asked to record your answer:

a. to the nearest tenth? one decimal place Example: 0.1

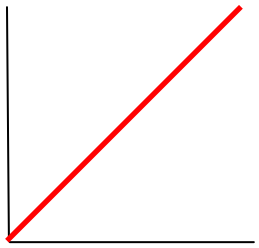
b. to the nearest hundredth? two decimal places Example: 0.01

c. to the nearest thousandth? three decimal places Example: 0.001

Graphical Relationships

A. Direct Relationship.

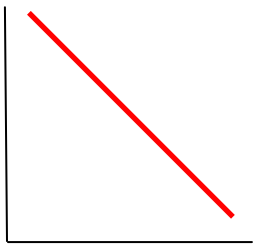
As one variable increases, the other _____increases_____.



Examples: **population vs. pollution**
distance from sun vs period of revolution

B. Inverse Relationship

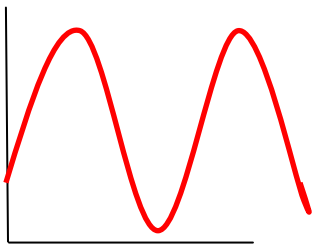
As one variable increases, the other _____decreases_____.



Examples: **distance vs gravitational attraction**
elevation vs average yearly temperature

C. Cyclic Relationship

As one variable increases, the other __changes in a predictable__ __pattern_____

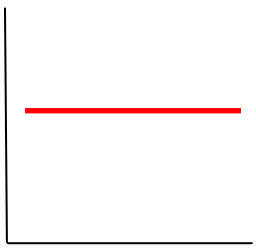


Examples: **phases of the moon, tides, yearly temperatures**

***Events that are cyclic are also ___predictable_____!**

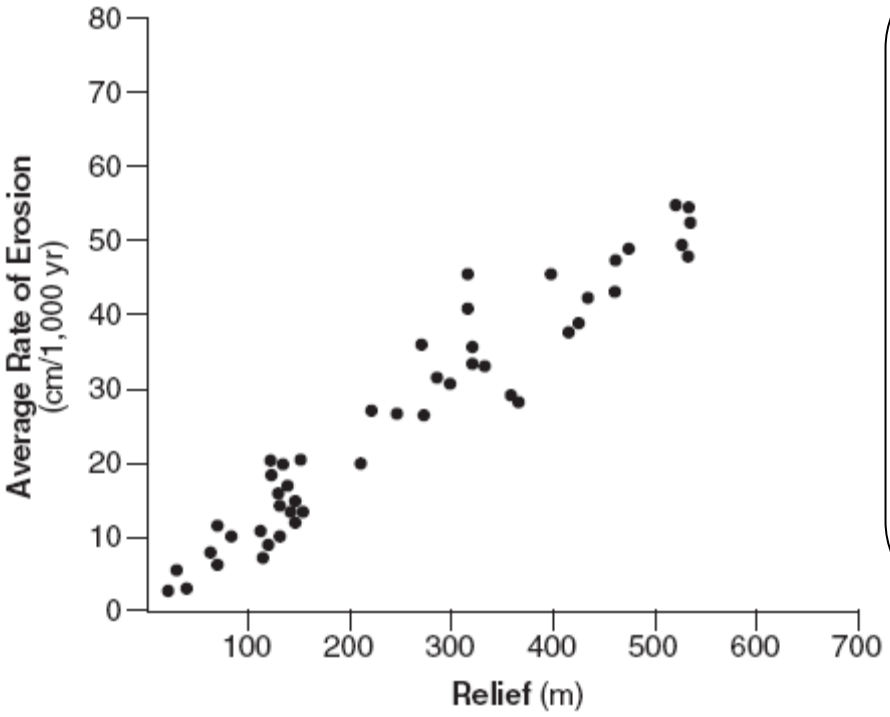
D. No relationship.

As one variable increases, the other _stays the same____.



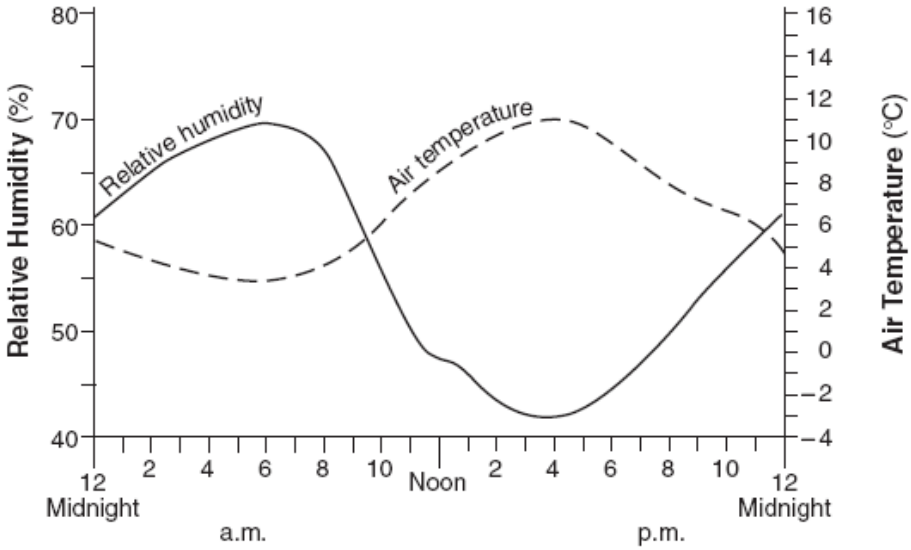
Examples: **time vs number of planets, time vs mass**

Graphical Relationships in Words



State in words the relationship between relief and the average rate of erosion as shown in the graph.

As the relief increases, the average rate of erosion increases. A direct relationship.



State in words the relationship between Air Temperature and Relative Humidity.

As the air temperature increases, the relative humidity decreases. An indirect relationship.

Observations, Inferences, Classification

What is used to make an observation?

the five senses

After observations have been collected. What does it mean to make an inference?

to make an educated guess, an hypothesis

Give examples of how scientists use classification systems.

types of rocks, types of stars

DENSITY, MASS, VOLUME

MASS:

Name the common scientific instrument used to measure mass: **scale, triple beam balance**

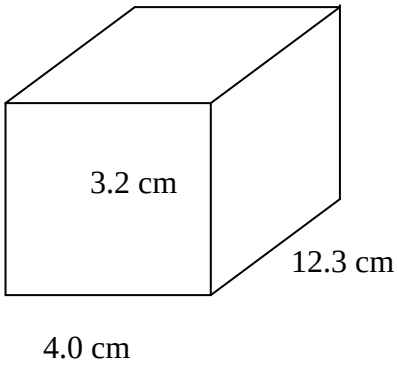
If an object is heated, what happens to its mass? **nothing**

Why? **the number of atoms stays the same**

If an object has a mass of 240g on Earth, its mass on the moon will be (more, less, **the same**).

Why? **the number of atoms stays the same**

VOLUME of a regular rectangular object:



What instrument would be used to measure this object's volume? ruler

What is the formula for finding the volume of this object?

V = L x W x H

Calculate the volume of this object to the *nearest tenth* of a cubic centimeter. Show all formulas.

V = L x W x H
= (3.2cm)(12.3cm)(4.0cm)
= 157.4 cm^3

VOLUME of an irregularly shaped object:

What instrument would a student use to measure the volume of an object such as a rock?
graduated cylinder

Describe the process you would use.
Put water into cylinder, Measure volume of water, Place object in cylinder, Re-measure volume of water, Subtract volumes

DENSITY of All Objects EXCEPT WATER:

DENSITY = HOW TIGHTLY PACKED THE ATOMS ARE

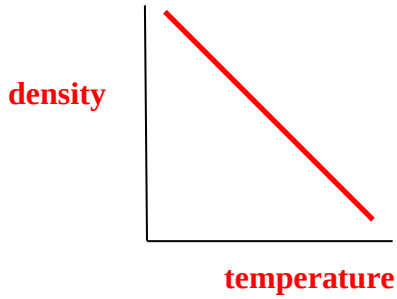
When an object is heated, it ____**expands**_____ and the atoms become (more, **less**) packed. Therefore the object becomes (more, **less**) dense.

When an object is cooled, it ____**contracts**_____ and the atoms become (**more**, less) packed. Therefore the object becomes (**more**, less) dense.

What happens to the density of an object when it is split into smaller parts? **density stays the same**

Why? **the packing of the atoms doesn't change**

What is the formula for density? **d = mass / volume**

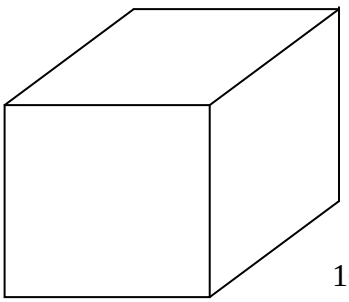


Sample problems:

1. A rock has a mass of 240g and a volume of 12cm³. Showing all formulas and calculations, determine the density of the rock. Record your answer *to the nearest tenth.*

density = mass / volume = 240g / 12 cm³ = 20 g/cm³

2. The box below has a mass of 120g. Showing all formulas and calculations, determine the density of the box. Record your answer *to the nearest tenth.*

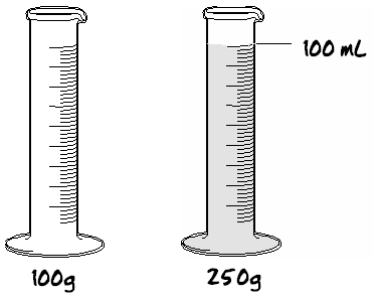


Volume = L x W x H
= (2.0cm)(10.0cm)(2.0cm)
= 40 cm³

Density = mass/volume
= 120g/40cm³
= 3 g/cm³

2.0 cm

3. If the empty container has a mass of 100g and the filled container has a mass of 250g. What is the density of the liquid inside? Record your answer *to the nearest tenth.* Show all work below.



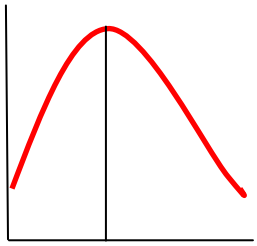
Mass of Liquid = Mass of Filled Cylinder – Mass of Empty Cylinder
= 250 g – 100 g
= 150g

Density of Liquid = mass / volume
= 150g/100mL
= 1.5 g/mL

DENSITY OF WATER:

Water is most dense at ___**3.98**____°C. This is because water ____**expands**___ above and below this temperature.

Draw the graph showing the density of water versus the temperature of water.



3.98°C

The density of water when it is most dense is: _____**1.00**_____ g/mL

FLOAT OR SINK?

Any material with a density greater than water will _____**sink**_____.

Any material with a density less than water will _____**float**_____.

Example. If an object has a mass of 25g and a volume of 50mL, will it sink or float in liquid water? Why?

Density = mass/volume = 25g/50mL = 0.5 g/mL

It will float because its density is less than the density of water (1.00 g/mL)

PHASES OF MATTER AND DENSITY

During which phase of matter (solid, liquid or gas) are most materials:
most dense?____**solid**_____

least dense?____ **gas**_____

Dynamic Equilibrium

Give a real life, earth science example of a system that is in dynamic equilibrium.

A lake that has a stream entering it and leaving at the same rate. The water in the lake is always changing, yet the height of the water stays the same.

Interfaces

Give a real-life, earth science example of an interface.

a weather front

Cyclic Events

Give three, real-life, earth science examples of cyclic events.

phases of the moon
sunspots
tides