

ANALYZING GRAPHS

INTRODUCTION

Scientists study the ways in which different objects and phenomena in the universe are related to one another. They frequently plot graphs with the information they collect in order to understand it better. The characteristics of the graphs usually reveal much about the relationships. Graphs indicate whether the relationships are direct, inverse, constant, or cyclic.

DIRECT: As the measurements for one variable increase, so do the values for the other

INVERSE: As the measurement for one variable increase, those for the other decrease

CONSTANT: As the values for one variable change, those for the other stay the same

CYCLIC: A relationship which shows an orderly series of events that repeats at regular intervals

DEPENDENT VARIABLE: The data that you are measuring in your observations.

Usually placed on the vertical axis.

INDEPENDENT VARIABLE: The data that you know in advance such as the time.

Usually placed on the horizontal axis.

OBJECTIVES

During this investigation you will be able to:

1. Determine the proper scale and label both axes.
2. Plot data points.
3. Draw a smooth curve through the points.
4. Determine the type of relationship shown by a graph.
5. Interpolate and extrapolate on a graph to get new data points.
6. Describe how the slope of a graph can give additional information.
7. Determine which axis dependent and independent variable data should be labeled.

APPROXIMATE TIME 2 Periods

MATERIALS

Calculator

PROCEDURE

1. Graph the data listed for each of the six graphs on the following pages, after **correctly labeling (and/or numbering)** the X and Y axes.
2. Determine the type of relationship shown by each graph.
3. Complete pie graph 7 and 8
4. Refer to graph 9 and answer the corresponding questions.
5. Complete the lab summary questions.

NOTE: To get an accurate scale subtract the highest number by the lowest number for the data given (range) then divide it by the number of boxes and round up to the nearest whole number (scale). Must include a break if the numbers do not start at zero.

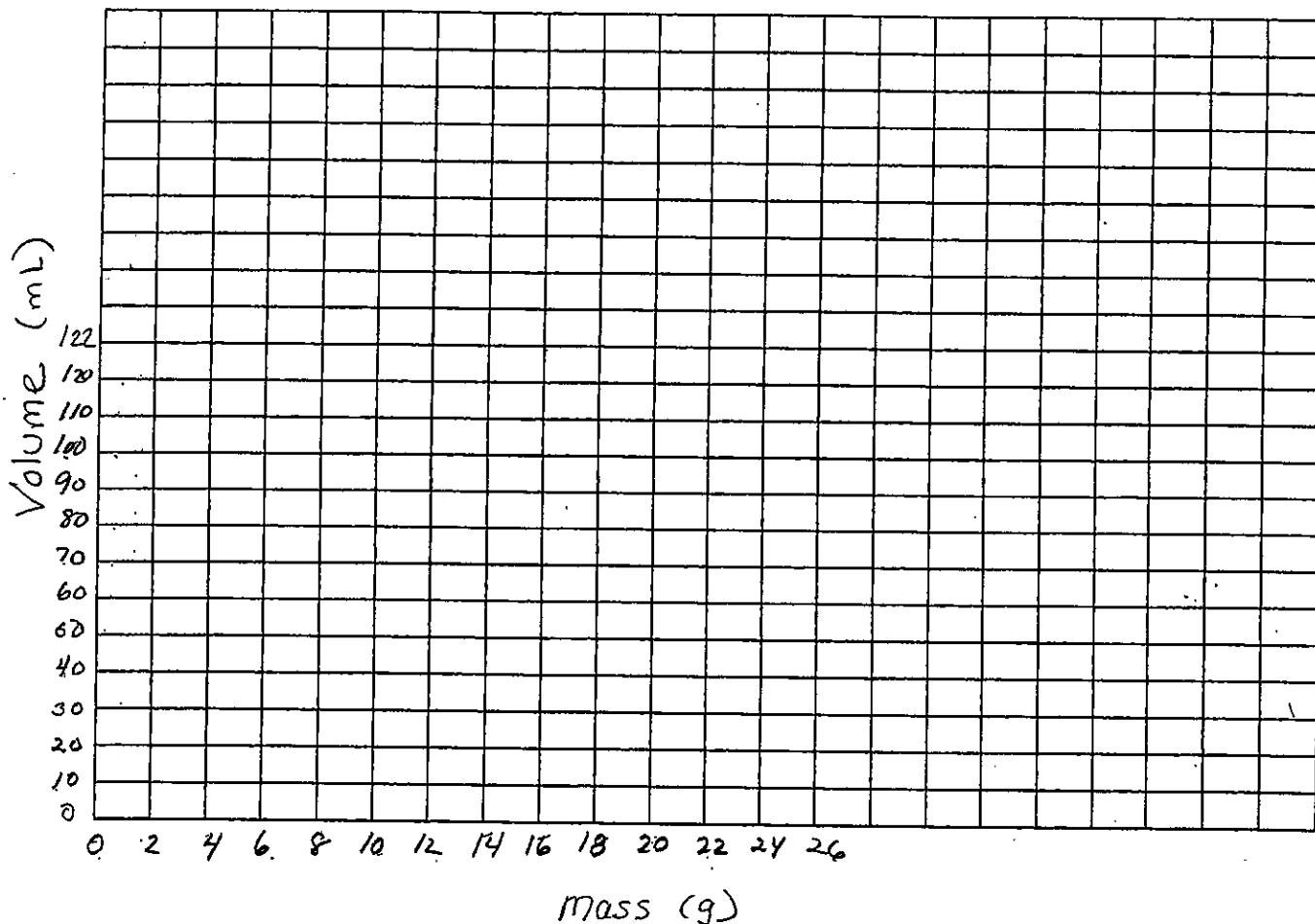
$$\text{Scale} = \frac{(\text{high value} - \text{low value})}{\text{number of boxes}}$$

GRAPH 1

While doing laboratory work on density, a group of students collected the following data on the mass and volume of various size samples of the mineral galena.

MASS AND VOLUME OF GALENA SAMPLES

MASS (grams)	5.0	9.2	14.8	18.3	23.6
VOLUME (mL)	25	46	74	91.5	118



Using a complete sentence **describe the relationship** between the mass and the volume of the galena samples.

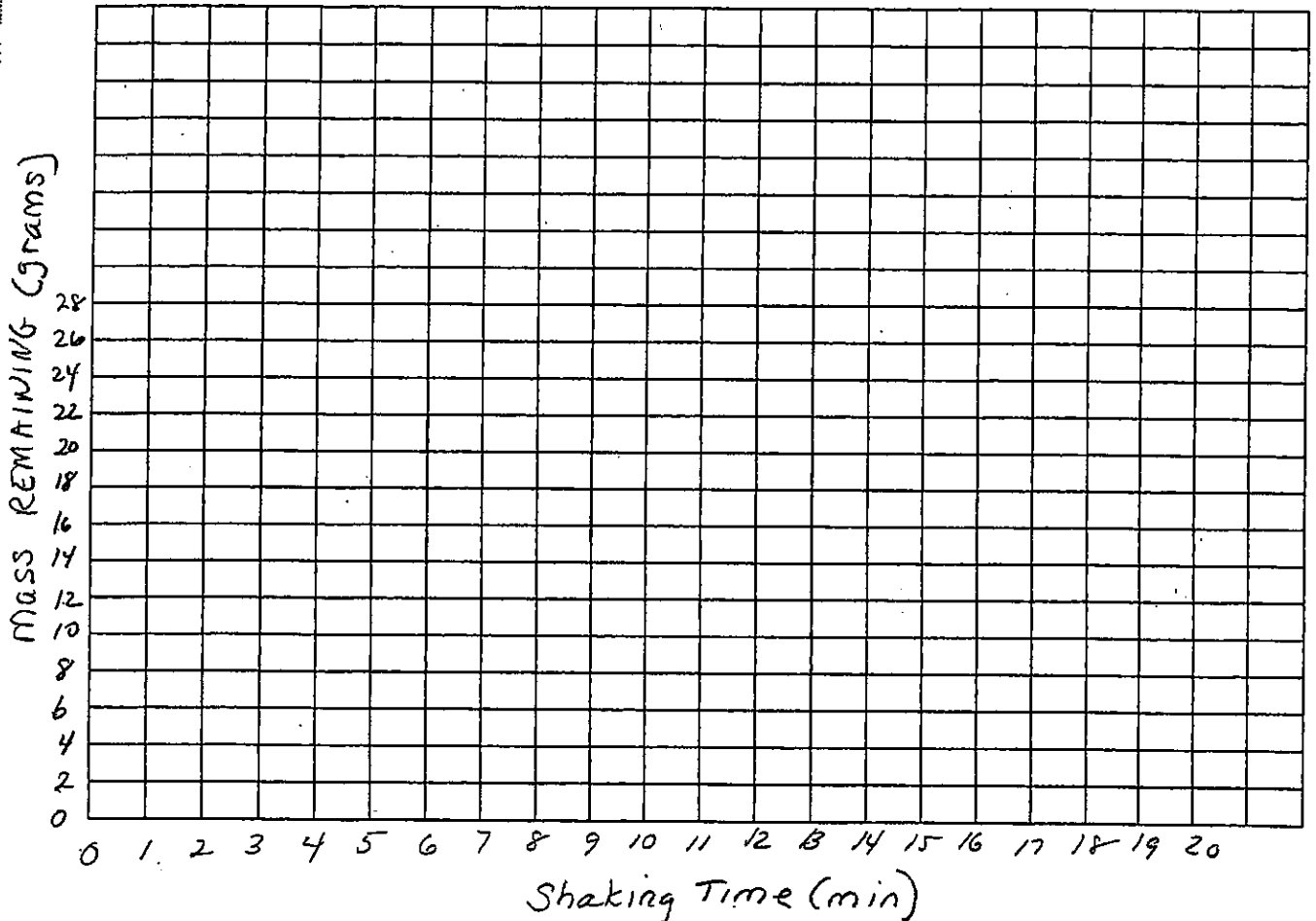
What **kind of relationship** is this and how does the graph show this relationship? _____

GRAPH 2

Samples of a rock material were placed in a container of water and shaken vigorously for 20 minutes. At 5-minute intervals, the contents of the container were strained through a sieve. The mass of the material remaining in the sieve was measured and recorded as shown in the data table below.

MASS OF MATERIAL REMAINING IN SIEVE

SHAKING TIME (min)	0	5	10	15	20
MASS REMAINING (grams)	25.0	17.5	12.5	7.5	5.0



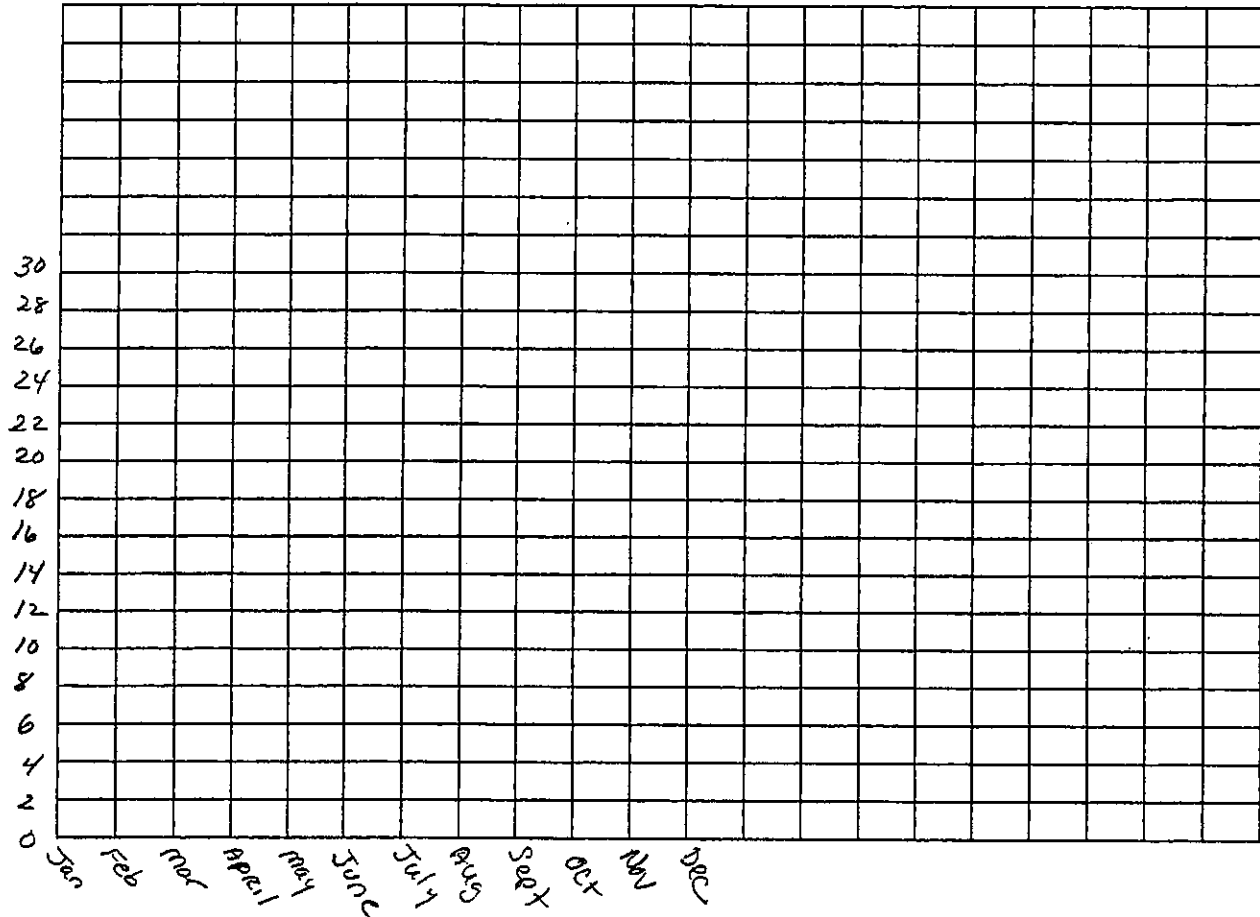
Using a complete sentence **describe the relationship** between shaking time and the mass remaining for the rock material.

What **kind of relationship** is this and how does the graph show this relationship? _____

GRAPH 3

RELATIONSHIP BETWEEN THE TILT OF THE EARTH'S AXIS AND MONTH

MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
TILT	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$	$23\frac{1}{2}$



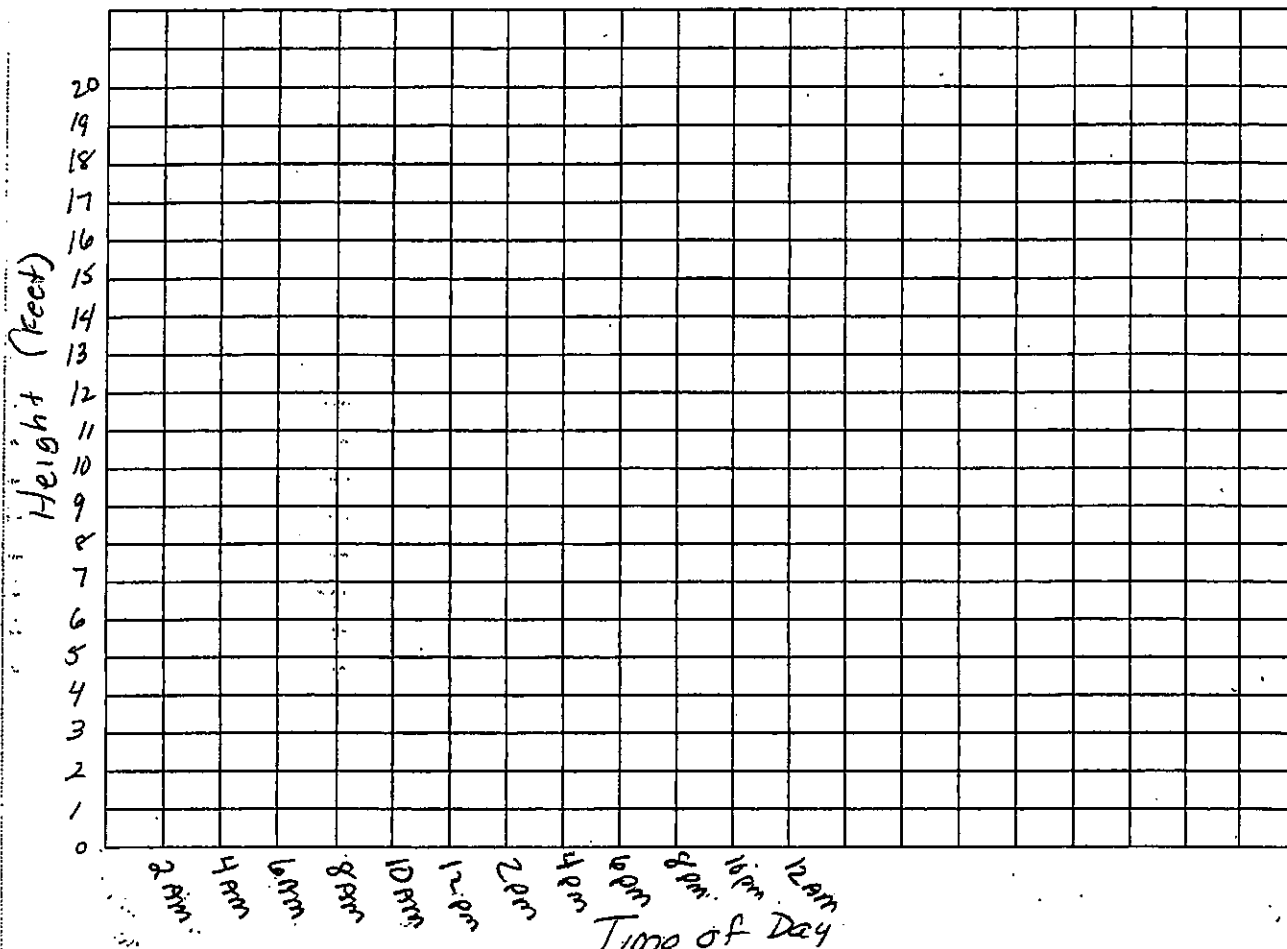
Using a complete sentence **describe the relationship** between the month of the year and the tilt of the Earth's axis.

What **kind of relationship** is this and how does the graph show this relationship? _____

GRAPH 4

RELATIONSHIP BETWEEN THE TIME OF DAY AND THE HEIGHT OF TIDES

TIME OF DAY	1:45 AM	4:00 AM	7:00 AM	9:00 AM	12:30 PM	3:00 PM	6:30 PM	9:00 PM	12:00 AM
HEIGHT (FEET)	9	16	8.5	3	10	15	6	2.5	9.5



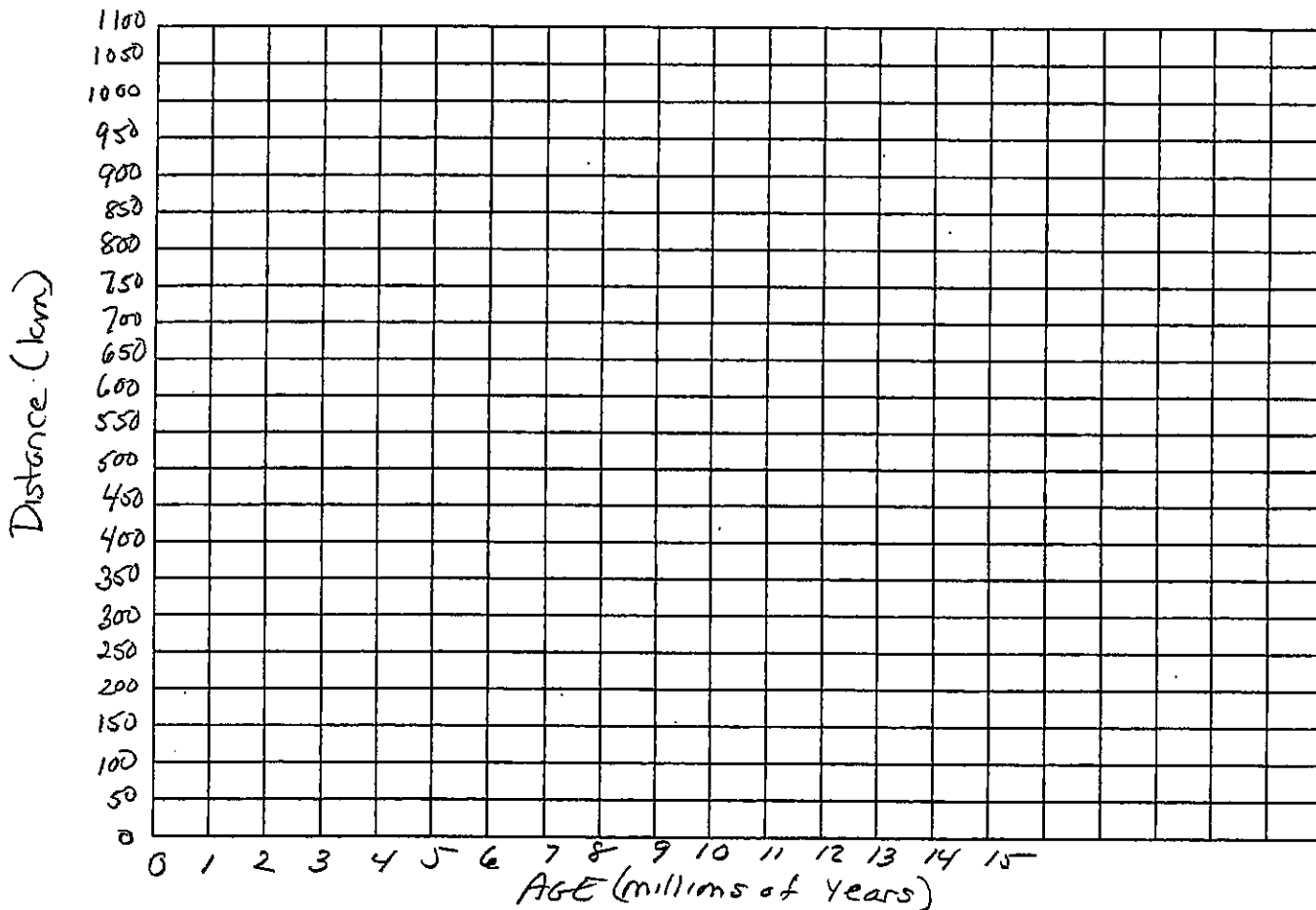
Using a complete sentence describe the relationship between the time of day and the height of the tides.

What kind of relationship is this and how does the graph show this relationship? _____

GRAPH 5

RELATIONSHIP BETWEEN THE DISTANCE FROM HAWAII AND THE AGE OF THE HAWAIIAN ISLAND

ISLAND (label the points)	HAWAII	MAUI	MOLOKAI	OAHU	KAUAI	NIHEA	NECKER
DISTANCE (KM)	0	200	250	400	550	800	1050
AGE (MILLION YRS)	0	1.3	1.8	3.6	5.6	7.5	10.0



Using a complete sentence **describe the relationship** between the distance from the island of Hawaii and the age of the island.

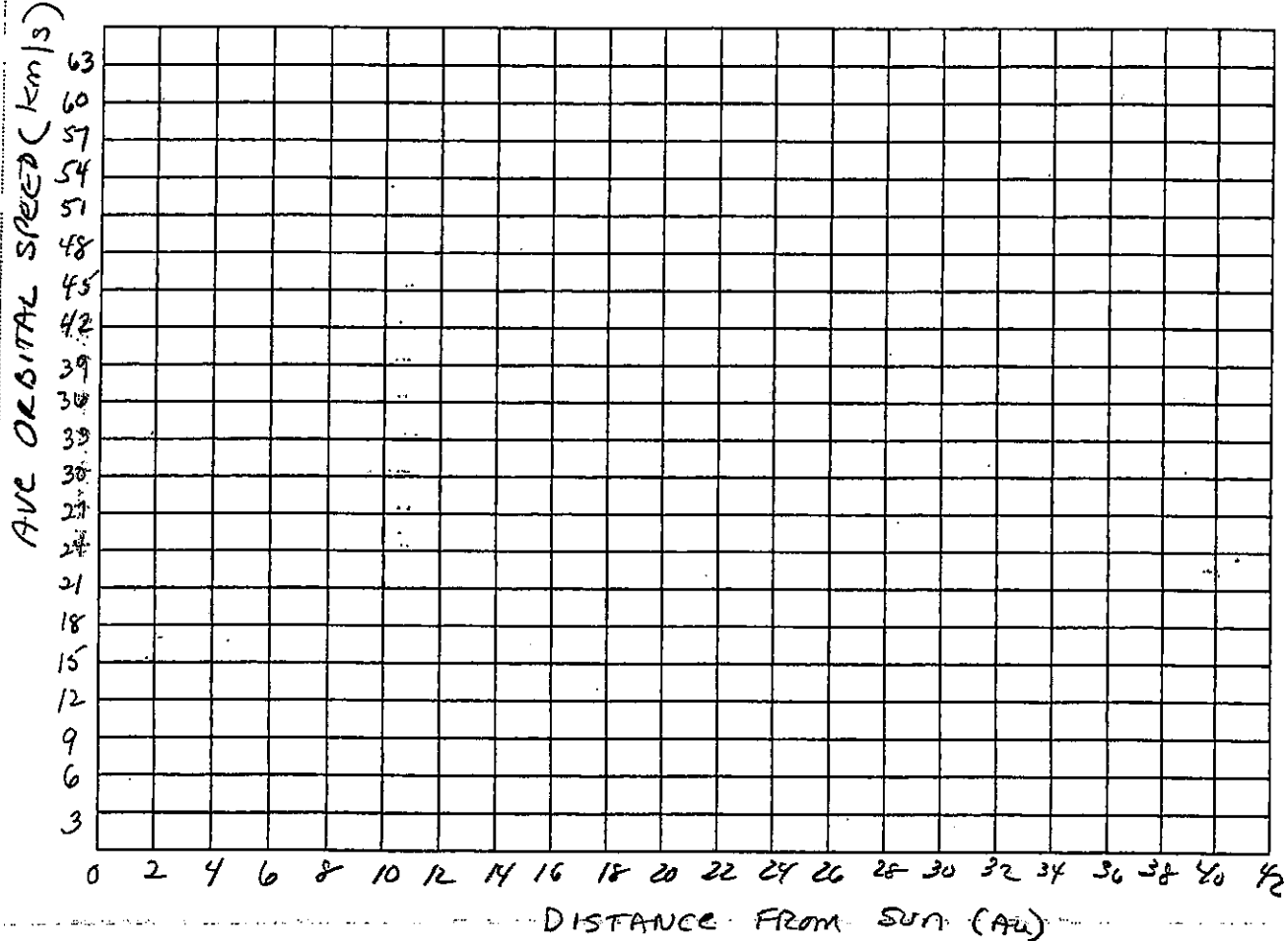
What **kind of relationship** is this and how does the graph show this relationship? _____

GRAPH 6

RELATIONSHIP BETWEEN THE AVERAGE DISTANCE FROM THE SUN AND THE AVERAGE ORBITAL SPEED OF THE EIGHT PLANETS

PLANET (labels)	MERC	VENUS	EARTH	MARS	JUPIT	SATUR	URAN	NEPTU
AVERAGE DISTANCE FROM SUN (AU)*	0.4	0.7	1.0	1.5	5.2	9.6	19.0	30.0
AVERAGE ORBITAL SPEED (km/s)	48.0	35.0	30.0	24.0	13.0	10.0	7.0	5.1

* 1 AU is equal to the average distance between the Sun and the Earth.



Using a complete sentence describe the relationship between the distance from the sun and the average orbital speed of the eight planets.

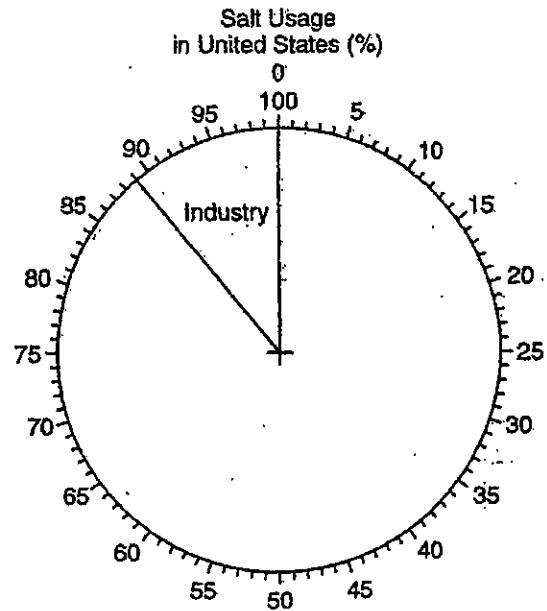
What kind of relationship is this and how does the graph show this relationship? _____

GRAPH 7 & 8

USES OF SALT IN THE UNITED STATES

ON THE PIE GRAPH PROVIDED, COMPLETE THE GRAPH TO SHOW THE PERCENT OF EACH SALT USAGE. (THE PERCENT OF SALT USED IN INDUSTRY HAS BEEN DRAWN AND LABELED.) LABEL EACH SECTION OF THE PIE GRAPH TO INDICATE SALT USAGE.

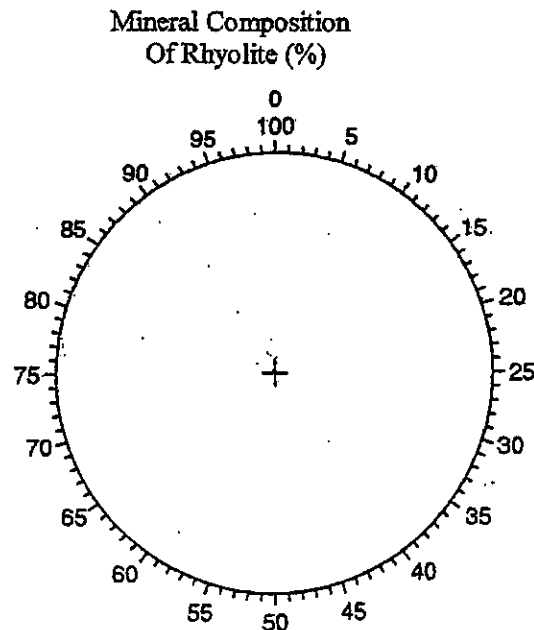
Salt Usage	Percent
Water Softening	9
Highways	69
Agriculture	6
Foods	5
Industry	11



MINERAL COMPOSITION OF RHYOLITE

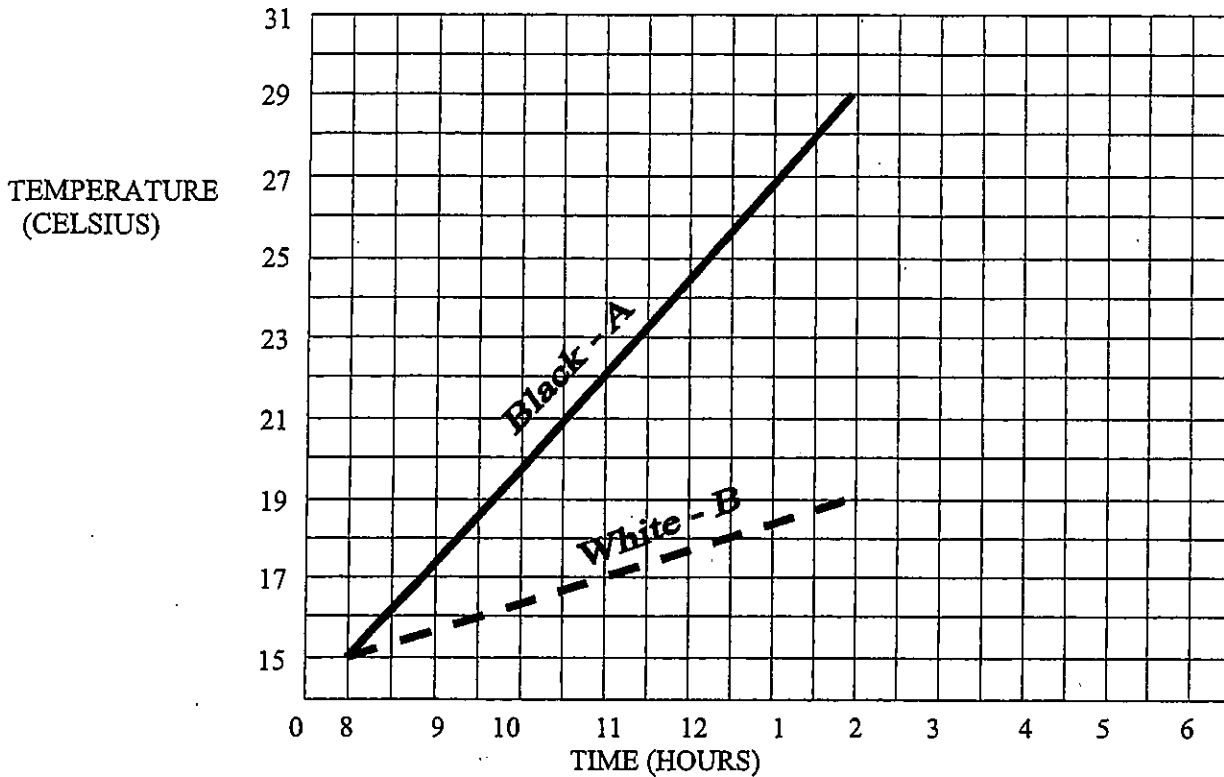
ON THE PIE GRAPH PROVIDED, COMPLETE THE GRAPH TO SHOW THE PERCENT OF EACH MINERAL FOUND IN A SAMPLE OF RHYOLITE. LABEL EACH SECTION OF THE PIE GRAPH TO INDICATE THE MINERAL CONTENT.

Mineral	Percent
Silica	73
Al Oxide	13
Fe & Mg Oxides	3
Others	11



GRAPH 9

THE FOLLOWING GRAPH SHOWS THE TEMPERATURE CHANGE INSIDE TWO PARKED CARS SITTING IN THE SUN. GRAPH A WAS FOR A CAR WITH A BLACK INTERIOR, AND GRAPH B FOR A CAR WITH A WHITE INTERIOR.



- 1) How many degrees did the temperature rise inside the car with the black interior? _____
- 2) How many degrees did the temperature rise inside the car with the white interior? _____
- 3) By looking at the graphs, which car showed the greatest RATE of temperature change? _____

How did you tell? _____

- 4) For graph A, calculate the rate of change (in degrees per hour) in temperature from 11 am to 2 pm. (Show formula and work).

- 5) For graph B, calculate the rate of change (in degrees per hour) in temperature from 11 am to 2 pm. (Show formula and work).

- 6) Based on the graphs, predict (extrapolate) what the temperature would most likely be at:

3 pm in the black car _____

4 pm in the white car _____

GRAPH 10 (BAR GRAPH)

Complete the graph below by drawing a bar to represent the time span that *each* human species existed. The bars for the first four species listed have already been drawn.

Human Species Distributed Through Time

Human Species	Time of Existence from Fossil Evidence (million years ago)
<i>Homo sapiens</i>	0.25 to the present
<i>Homo neanderthalensis</i>	0.35 to 0.03
<i>Homo rhodesiensis</i>	0.6 to 0.1
<i>Homo heidelbergensis</i>	0.6 to 0.3
<i>Homo mauritanicus</i>	1.2 to 0.6
<i>Homo erectus</i>	1.5 to 0.2
<i>Homo ergaster</i>	1.8 to 1.25
<i>Homo habilis</i>	2.25 to 1.4

