

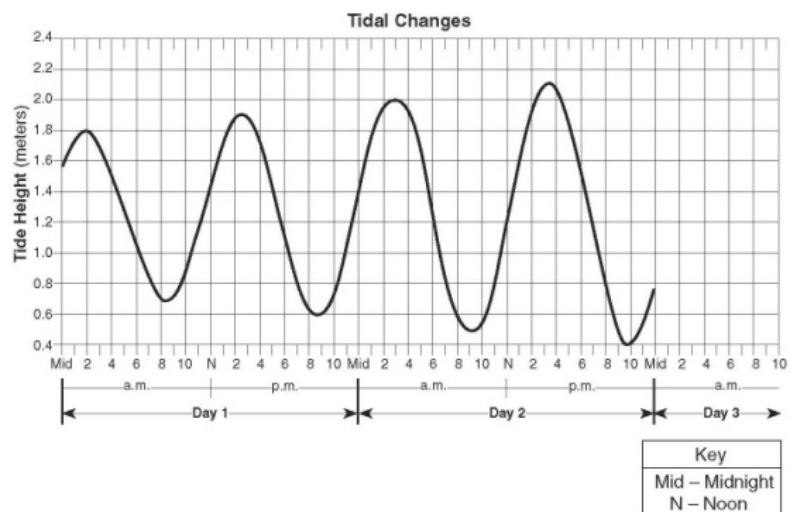
NAME: _____

INTRODUCTION TO EARTH SCIENCE NOTES

Log onto YouTube and search for [jocrisci channel](#). All video listed with numbers below and sorted into playlists for easy access.

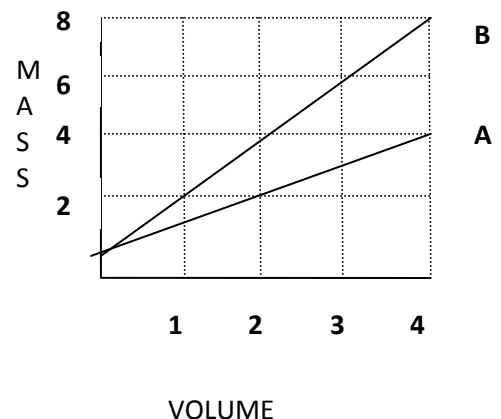
GRAPHING (Video 1.2)

- Look at a data table:
 - Determine which column contains the X data, and which contains the Y data
 - Calculate the correct scale to use for the X and Y axes.
 - Plot the data
 - Connect the data points with a line
- Look at a graph. Explain which type of relationship that it shows.
- Look at a cyclic graph.
 - Calculate the length of a cycle
 - Label the maxima and minima
 - Using your calculated cycle length, make a prediction as to when the next maximum and minimum will occur



FORMULAS AND WORD PROBLEMS (Video 1.3 ESRT 1b)

- Look at a data table. Calculate the rate of change (using the formula in your reference tables), rounding your answer to the nearest tenth and including the correct units.
- Find the density of the following:
 - A cube has a mass of 128 grams and a density of 2 gm/cc. Find the length of one side.
 - A rectangle has a length of 5 cm, a width of 4 cm, and a height of 2 cm. It has a density of 3 gm/cc. Calculate its mass.
 - Using the graph to the right, find the density of objects A and B.



Introduction to Earth Science Facts

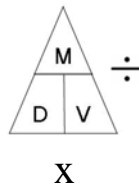
Video 1.1

1. Observation is / using your five senses to gather information
2. Inference is / making an educated guess based on your observations
3. Classification is / grouping of objects based on their characteristics

Video 1.2

4. Direct relationship means / as one variable increases the other increases
5. Inverse relationship means / as one variable increases the other decreases
6. Constant relationship means / as one variable increases the other stays the same
7. Cyclic relationship means / as one variable increases the other variable repeats in a pattern and is predictable (ex. Moon Phases, Tides, and Seasons)

8. Density is / how close or compact the molecules are
9. Density triangle / cover up the variable you want to solve for:



Video 1.3 ESRT 1b

10. The same objects have the / same density **NO MATTER WHAT SIZE**
11. As temperature increases / density decreases (molecules spread out) and volume increases (inverse relationship)
12. Warm air or water rises because / it is less dense than cold air or water
13. Cold air or water sinks because / it is more dense than warm air or water
14. As pressure increases / density increases (molecules move closer together)
15. Water has a density of / 1.0 g/cm^3 when it is still a liquid at 4°C
16. For objects with densities less than 1, the lower it is / the higher it floats
17. As water freezes it becomes / less dense (That is why ice floats)

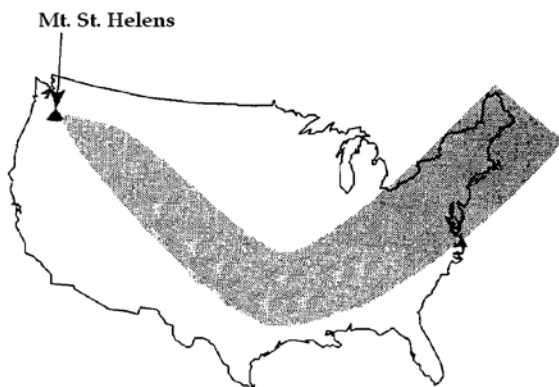


For each statement below, determine if it is an observation or an inference and explain your choice.

Statement	Observation or Inference	Reason
1) The sample was transported by a glacier over 1 million years ago.		
2) The sample is rectangular, with sharp, angular corners.		
3) The water will become unsafe within 5 years.		
4) Some of the snow on the glacier is powdery.		
5) The sample is 8 cm long, 5 cm wide, and 3 cm high.		
6) Hot and humid conditions will continue throughout the week.		
7) There are many cracks in the glacier.		
8) The sample is white in color.		
9) A meteor impact caused the extinction of the dinosaurs.		
10) The rocks in the glacier are different sizes.		
11) The rock is spherical and must have been transported here by a stream.		
12) Some parts of the glacier will start melting this spring.		

Questions: Choose the word or statement that best answers the question.

- 1) Using a ruler to measure the length of a stick is an example of
 - (1) Extending the sense of sight by using an instrument
 - (2) Calculating the percent error by using a proportion
 - (3) Measuring the rate of change of the stick by making inferences
 - (4) Predicting the length of the stick by guessing
- 2) Which action can be performed most accurately using only the human senses?
 - (1) Tearing a sheet of paper into squares whose sides measure 1 centimeter
 - (2) Adding 10 grams of salt to a cup of water
 - (3) Measuring the air pressure of a room
 - (4) Counting 28 shells from a beach
- 3) The map below shows the path of an ash cloud that results from the Mount St. Helens volcanic eruption. The map was developed from satellite photographs.



The path of the ash cloud was most probably determined by

- (1) hypothesis
 - (2) inference
 - (3) observation
 - (4) theory
- 4) An interpretation based upon an observation is called
 - (1) fact
 - (2) an inference
 - (3) a classification
 - (4) a measurement
- 5) While on a field trip to a large lake in New York State, an observer recorded four statements about this lake. Which of these statements is most likely an inference?
 - (1) The lake was formed by glacial action
 - (2) The water is clear enough to see the bottom of the lake.
 - (3) A log is floating in the lake.
 - (4) The surface temperature of the lake is 18.5°C.
- 6) The grouping of objects or events based on similar characteristics is called
 - (1) observation
 - (2) interpretation
 - (3) measurement
 - (4) classification
- 7) A student classifies several objects. The classification system should be based on
 - (1) hypotheses
 - (2) inferences
 - (3) observations
 - (4) interpretations
- 8) A prediction of next winter's weather is an example of
 - (1) an observation
 - (2) an inference
 - (3) classification
 - (4) a measurement

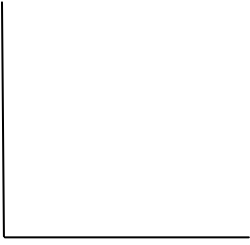


Graphical Relationships

A. Direct Relationship.

As one variable increases, the other _____.

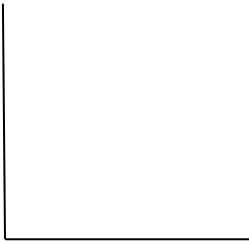
Examples:



B. Inverse Relationship

As one variable increases, the other _____.

Examples:

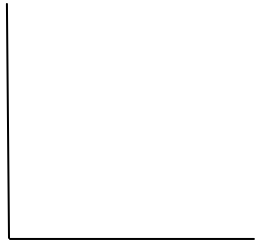


C. Cyclic Relationship

As one variable increases, the other _____

Examples:

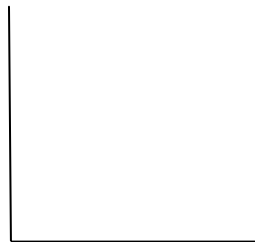
*Events that are cyclic are also _____!



D. No relationship.

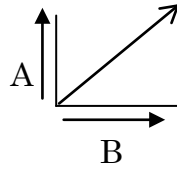
As one variable increases, the other _____.

Examples:



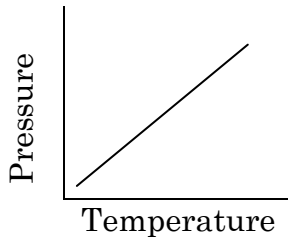
Line Graphs

When interpreting a graph, read the bottom variable first. This is your independent variable. Then, read the side variable and describe what the line in the center of the graph is doing.



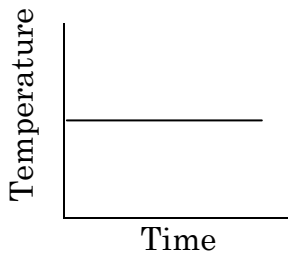
As "B" increases,
"A" increases

Write out the relationships for each of the following graphs:

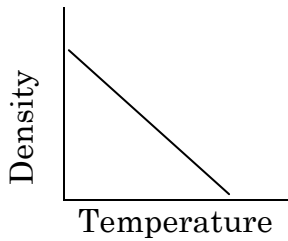


As temperature increases,

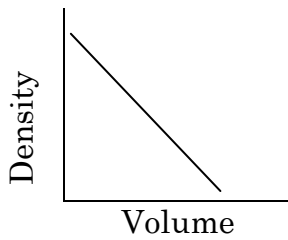
Pressure _____



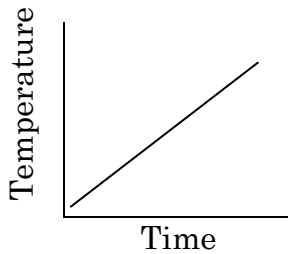
As



As



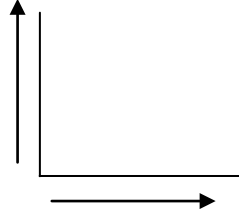
As



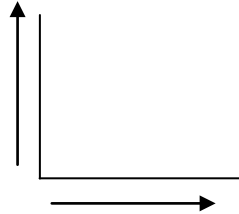
As

Draw a graph for each of the following relationships:

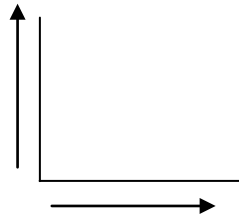
As depth increases,
pressure increases



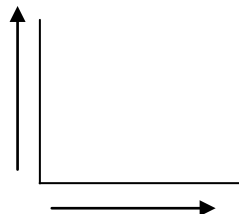
As depth increases,
density increases



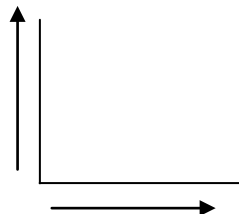
As altitude increases,
temperature decreases



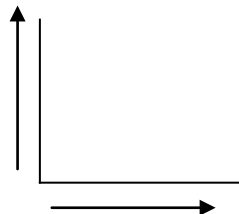
As population increases,
pollution increases



As the amount of studying
increases, grades increase



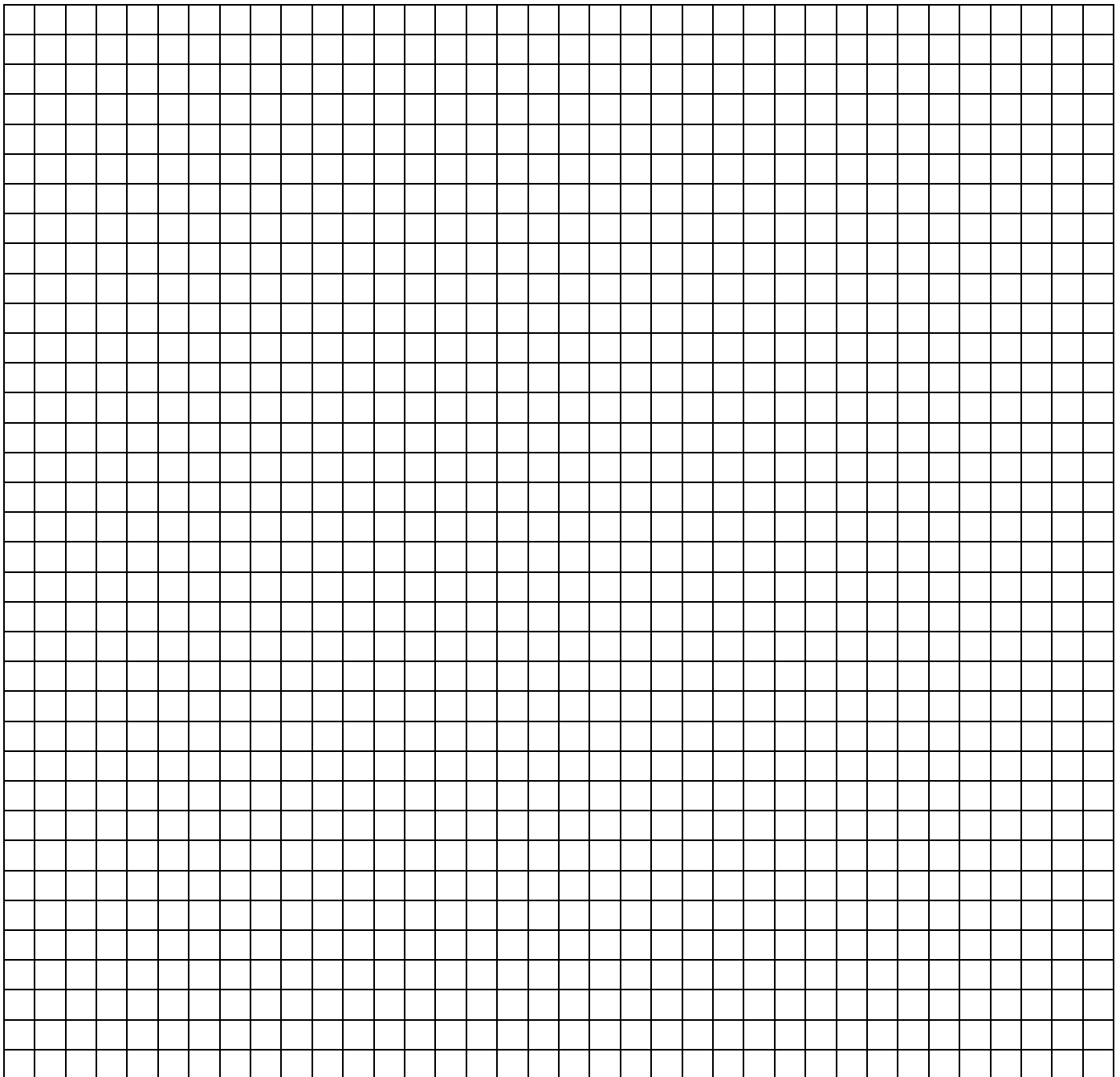
As time increases,
velocity remains the same



Thousands of Years Ago	CO ₂ Concentration
4	198
15	209
28	200
38	192
48	179
57	188
65	174
81	166
114	156
136	165

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.

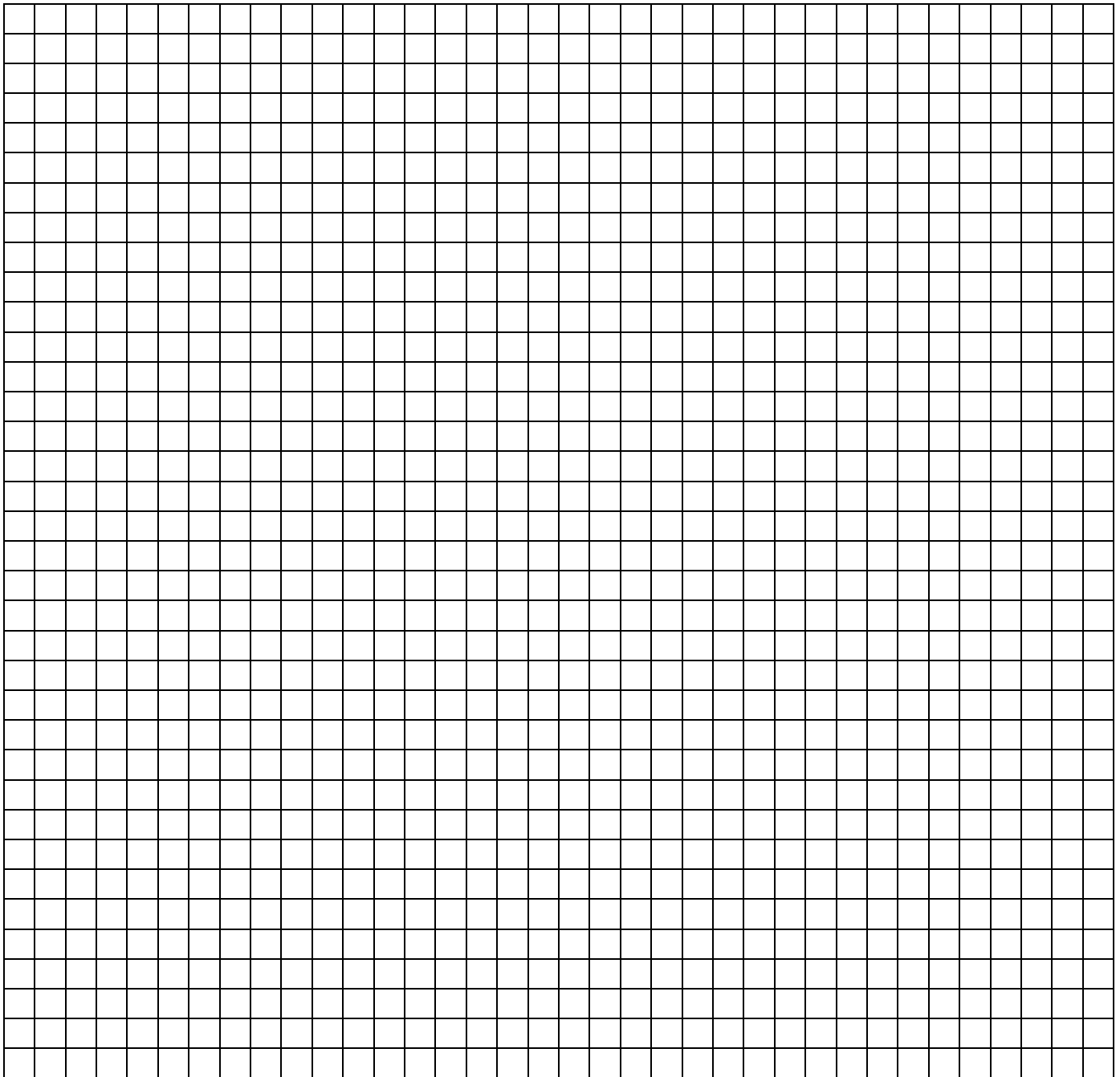
$$\text{Scale} = \frac{(\text{high value} - \text{low value})}{\text{number of boxes}}$$



Height (mi)	Number of Ozone Molecules
8	20
18	40
25	60
42	80
58	100
82	105
101	127
105	152
116	230
119	248
128	250
138	240
156	180

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.

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



SIMPLE MATH SKILLS

Round to the nearest tenth:

- | | |
|-------------------|------------------|
| 1) 5.77 _____ | 10) 0.98 _____ |
| 2) 13.74 _____ | 11) 1.02 _____ |
| 3) 0.667 _____ | 12) 7.984 _____ |
| 4) 77.37 _____ | 13) 8.253 _____ |
| 5) 829.25 _____ | 14) 18.96 _____ |
| 6) 513.8678 _____ | 15) 125.48 _____ |
| 7) 11.1723 _____ | 16) 0.956 _____ |
| 8) 9.97680 _____ | 17) 37.247 _____ |
| 9) 18.4835 _____ | 18) 1.5197 _____ |

Subtract the following times:

Write your answers with hours, minutes and seconds (hh:mm:ss)

1. $\begin{array}{r} 10:09:50 \\ -10:08:25 \\ \hline \end{array}$	2. $\begin{array}{r} 9:45:10 \\ -9:25:10 \\ \hline \end{array}$	3. $\begin{array}{r} 3:15:33 \\ -3:14:43 \\ \hline \end{array}$	4. $\begin{array}{r} 7:22:55 \\ -7:21:55 \\ \hline \end{array}$
5. $\begin{array}{r} 4:15:57 \\ -4:14:30 \\ \hline \end{array}$	6. $\begin{array}{r} 1:24:43 \\ -1:22:05 \\ \hline \end{array}$	7. $\begin{array}{r} 2:05:17 \\ -1:55:34 \\ \hline \end{array}$	8. $\begin{array}{r} 8:17:05 \\ -7:30:05 \\ \hline \end{array}$
9. $\begin{array}{r} 6:57:32 \\ -5:58:33 \\ \hline \end{array}$	10. $\begin{array}{r} 8:17:28 \\ -7:45:36 \\ \hline \end{array}$	11. $\begin{array}{r} 12:59:59 \\ -11:04:21 \\ \hline \end{array}$	12. $\begin{array}{r} 5:02:03 \\ -4:59:59 \\ \hline \end{array}$
13. $\begin{array}{r} 04:28:53 \\ -03:52:41 \\ \hline \end{array}$	14. $\begin{array}{r} 07:49:36 \\ -04:03:51 \\ \hline \end{array}$	15. $\begin{array}{r} 09:15:24 \\ -02:16:25 \\ \hline \end{array}$	16. $\begin{array}{r} 11:25:14 \\ -01:02:19 \\ \hline \end{array}$

Scientific Notation

Convert the following numbers into scientific notation:

1) 3,400 _____

2) 0.000023 _____

3) 101,000 _____

4) 0.010 _____

5) 45.01 _____

6) 1,000,000 _____

7) 0.00671 _____

8) 4.50 _____

Convert the following numbers into standard notation:

9) 2.30×10^4 _____

10) 1.76×10^{-3} _____

11) 1.901×10^{-7} _____

12) 8.65×10^{-1} _____

13) 9.11×10^3 _____

14) 5.40×10^1 _____

15) 1.76×10^0 _____

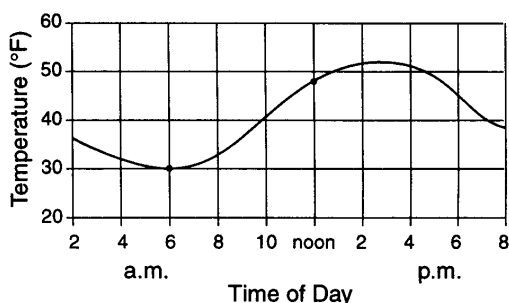
16) 7.4×10^{-5} _____

Rate of Change

Formula for
Rate of Change

Graphs

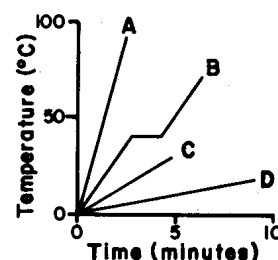
- The temperature of water in a container was 60°C . Ten minutes later, the water temperature was 35°C . What was the rate of cooling of the water?
(1) $25^{\circ}\text{C}/\text{min}$ (2) $2.5^{\circ}\text{C}/\text{min}$ (3) $35^{\circ}\text{C}/\text{min}$ (4) $3.5^{\circ}\text{C}/\text{min}$
- The graph below shows the temperature readings for a day in April.



The average rate of temperature change, in Fahrenheit degrees per hour, between 6 a.m. and noon was

- (1) $6^{\circ}/\text{hr}$ (3) $3^{\circ}/\text{hr}$
(2) $8^{\circ}/\text{hr}$ (4) $18^{\circ}/\text{hr}$

Use the graph to the right to answer questions 3 and 4. The graph represents the relationships between temperature and time as heat is added at a constant rate to equal masses of four substances labeled A, B, C, and D.



- The temperature of which substance increased the most rapidly? _____
- Which substance has a change that is not at a constant rate? _____
- Calculate the average daily rate of movement of the hurricane during the period from 3 p.m. August 24 to 3 p.m. August 28. The hurricane traveled 2,600 kilometers during this 4-day period.

6. A student measures and records the temperature of water in a beaker for 8 minutes as shown below.

	Start								Finish
Time	0 min	1 min	2 min	3 min	4 min	5 min	6 min	7 min	8 min
Temperature	90°C	83°C	78°C	73°C	68°C	64°C	60°C	57°C	54°C

What is the average rate of cooling for the water in the beaker during the 8-minute time interval?

- (1) 3.2 °C/min (2) 3.6 °C/min (3) 4.5 °C/min (4) 4.0 °C/min

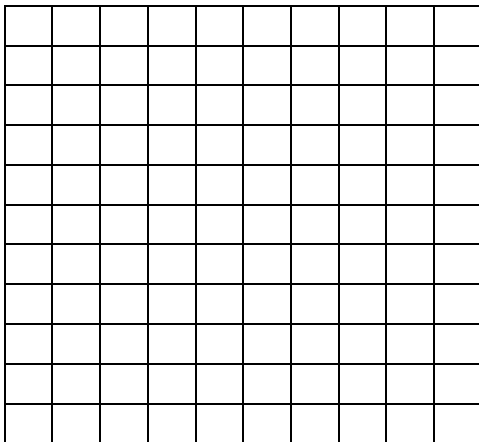
7. From 12 noon Thursday until 8 p.m. Thursday, the total amount of snowfall was 12 inches. Calculate the snowfall rate, in inches per hour.

- (1) 0.67 in/hr (2) 2.5 in/hr (3) 1.5 in/hr (4) 3.5 in/hr

8. Create a line graph using the following steps.

- (a) Determine the correct scale that will best fit the data in the table below.
 (b) Remember to label the axis with units.
 (c) Plot the data and connect the points.

Time (min)	0	1	2	3	4	5	6	7	8	9	10
Temperature (°C)	0	0	2	3	4	4	5	6	6	8	10



- (a) Determine the average rate of temperature change that occurred during this experiment.

- (b) By looking at the line graph, did the *rate of temperature change* stay the same throughout the experiment? _____

Explain how you can tell. _____



Density of Matter

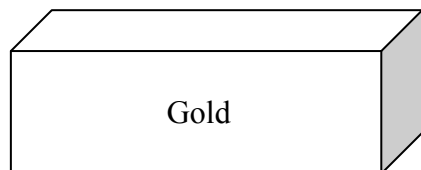
Density - _____

Formula:

A. Density Properties:

- _____
 - _____

Example:



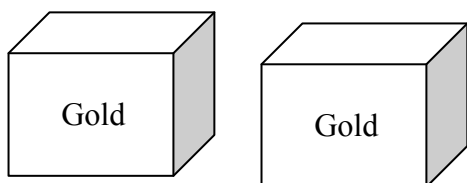
Mass = 162 g

Volume = 8.4 cm³

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{\text{g}}{\text{cm}^3}$$

Density = _____ g/cm³

If you take that sample of gold and break it into two exact halves, the mass and volume is half of the original, but the density remains the same.



Mass = 81 g

Volume = 4.2 cm³

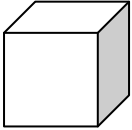
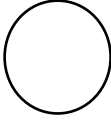

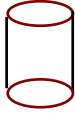
$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{\text{g}}{\text{cm}^3}$$

Density = _____ g/cm³

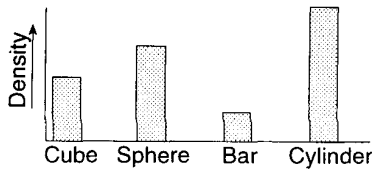
Practice questions:

- If a wooden block were cut into eight identical pieces, the density of each piece compared to the density of the original block would be
 (1) less (2) greater (3) the same
- Under the same conditions of temperature and pressure, three different samples of the same uniform substance would have the same
 (1) shape (2) density (3) mass (4) volume

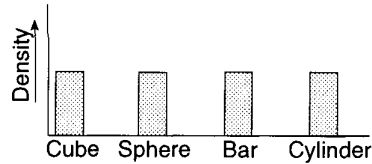
Base your answers to questions 3 through 6 on the diagrams below which represent four solid objects made of the same uniform material. The volume of the sphere and the mass of the bar are not given.

<p>Cube</p>  <p>Mass 81 g Volume 27 cm³</p>	<p>Sphere</p>  <p>Mass 75 g Volume ?</p>	<p>Bar</p>  <p>Mass ? Volume 30 cm³</p>	<p>Cylinder</p>  <p>Mass 60 g Volume 20 cm³</p>
---	---	---	---

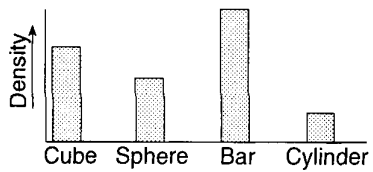
- 3) What is the density of the bar?
 (1) 9.9 g/cm³ (2) 30.0 g/cm³ (3) 3.0 g/cm³ (4) 90.0 g/cm³
- 4) Which graph best represents the relative densities of the objects?



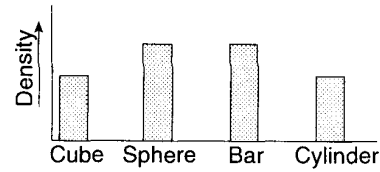
(1)



(3)



(2)



(4)

- 5) What is the mass for the bar?
 (1) 90 g (2) 10 g (3) 30 g (4) 3 g
- 6) What is the volume of the sphere?
 (1) 5 cm³ (2) 15 cm³ (3) 25 cm³ (4) 35 cm³
- 7) An unknown sample has a density of 6.0 grams per cubic centimeter. If the sample were cut in half, each have would have a density of
 (1) 12.0 g/cm³ (2) 9.0 g/cm³ (3) 3.0 g/cm³ (4) 6.0 g/cm³
- 8) The original sample A is cut into several pieces. When compared with the density of the original sample, the density of each piece will be
 (1) less (2) greater (3) the same



B. Change in Density:

Two factors that do effect density are _____ and _____

1. **Temperature** As temperature increases, molecules begin to move a part (expand), which means the volume increases.

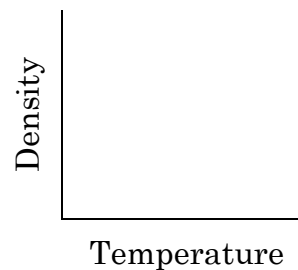
(a) Warm air _____ because it is _____ dense.

An example would be a _____

(b) State the relationship between temperature and density.

As _____,

(c) Draw the relationship between temperature and density in the graph below.



Phases of Matter:

(a) Most materials have their greatest density as a _____
The exception is water, because water _____ when it freezes.

(b) Water is at its greatest density at a temperature of _____ °C
The density of water is _____ g/ml

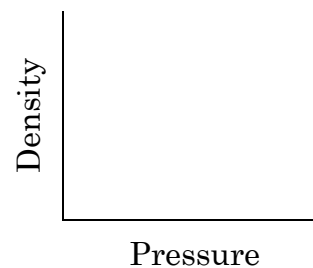
(c) If an object floats on water, it is _____ dense than the water.
If an object sinks in water, it is _____ dense than the water.

2. **Pressure:** When pressure is added, it causes the material to become smaller (compress), volume decreases.

(a) State the relationship between pressure and density.

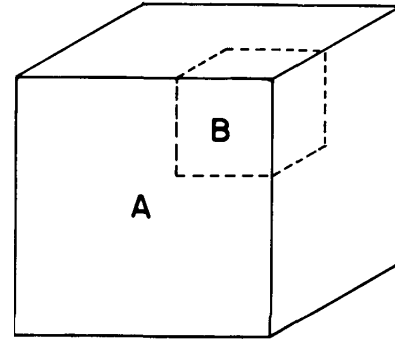
As _____,

(b) Draw the relationship between pressure and density in the graph below.



Practice problems:

Base your answers to questions on 1 and 3 on the diagram below. Object *A* is a solid cube of uniform material having a mass of 65 grams and a volume of 25 cubic centimeters. Cube *B* is a part of cube *A*.



- 1) The density of the material in cube *A* is determined at different temperatures and phases of matter. At which temperature and in which phase of matter would the density of cube *A* most likely be greatest?
 - (1) at 20°C and in the solid phase
 - (2) at 200°C and in the solid phase
 - (3) at 1800 °C and in the liquid phase
 - (4) at 2700°C and in the gaseous phase

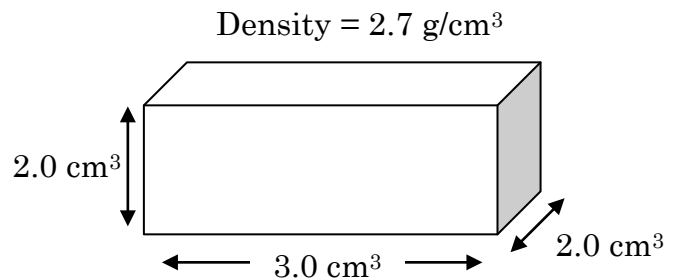
- 2) If cube *B* is removed from cube *A*, the density of the remaining part of cube *A* will
 - (1) decrease
 - (2) increase
 - (3) remain the same

- 3) The mass of cube *B* is measured in order to calculate its density. The cube has water on it while its mass is being measured. How would the calculated value for density compare with the actual density?
 - (1) The calculated density value would be less than the actual density.
 - (2) The calculated density value would be greater than the actual density.
 - (3) The calculated density value would be the same as the actual density.

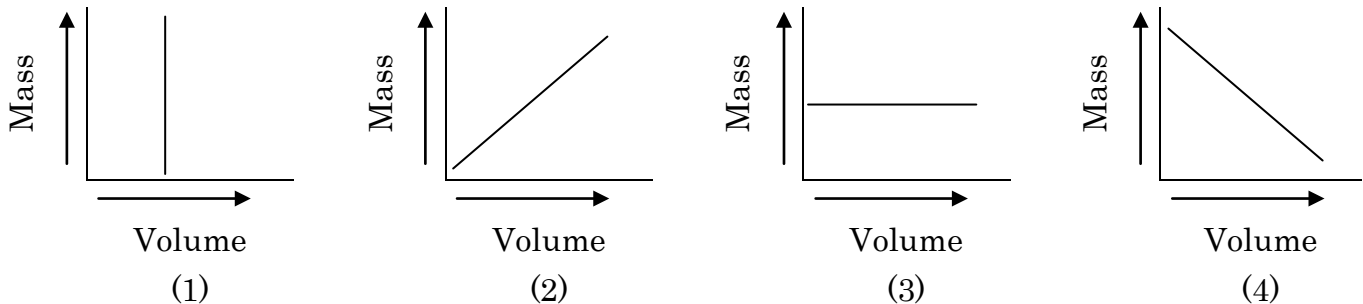
Base your answers to questions 4 through 6 on the diagram below, which represents a solid material of uniform composition.

- 4) What is the mass of the material?
 - (1) 18.9 g
 - (2) 32.4 g
 - (3) 4.5 g
 - (4) 40 g

- 5) If this material is heated and expands, the density of the material will
 - (1) decrease
 - (2) increase
 - (3) remain the same



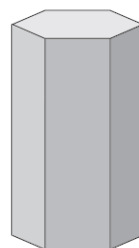
- 6) Which graph best represents the relationship between the mass and volume of various-sized pieces of this material?



- 7) As water cools from 4°C to 0°C, its density
 (1) decreases (2) increases (3) remains the same
- 8) As the volume of air expands due to heating, the density of this air will
 (1) decrease (2) increase (3) remain the same
- 9) Water has the greatest density at approximately
 (1) 100°C in the gaseous phase (3) 4°C in the solid phase
 (2) 0°C in the solid phase (4) 4°C in the liquid phase

Base your answers to questions 10 and 11 on the diagram below, which is an irregularly shaped objects in which certain measurements were made.

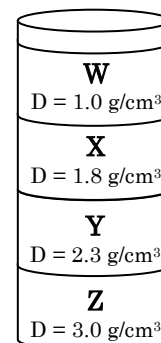
- 10) A student measured the mass and volume of the mineral crystal below and recorded the data shown below. The student used these data to calculate the density of the crystal. What is the density according to the student's data?
 (1) 1.0 g/cm³ (3) 2.0 g/cm³
 (2) 1.5 g/cm³ (4) 2.5 g/cm³



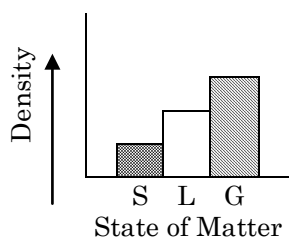
Data
Mass = 80 g
Volume = 32 cm ³
Density = ?

- 11) What is the student's percent error if the actual density of the crystal is 2.7 grams per cubic centimeter?
 (1) 0.4% (2) 5.0% (3) 7.4% (4) 8.0%

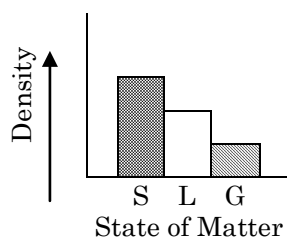
- 12) The diagram to the right represents a cylinder which contains four different liquids, W, X, Y, and Z, each with a different density (D) as indicated. A piece of solid quartz having a density of 2.7 g/cm³ is placed on the surface of liquid W. Which the quartz is released, it will pass through
 (1) W, but not X, Y, or Z (3) W, X, and Y, but not Z
 (2) W and X but not Y, or Z (4) W, X, Y, and Z



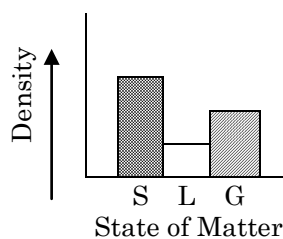
- 13) Which graph best represents the relationship between the density of a substance and its state of matter (phase) for most earth materials, *excluding* water?



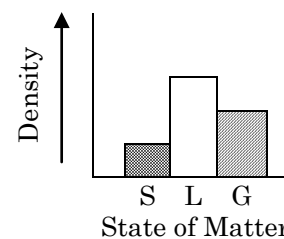
(1)



(2)

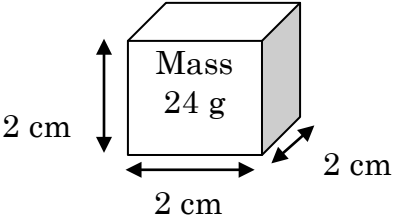
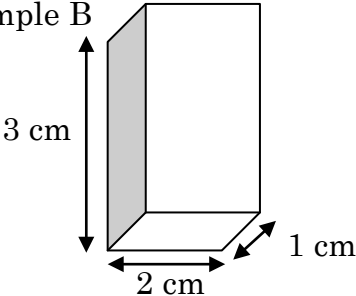
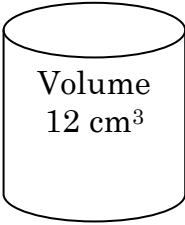


(3)



(4)

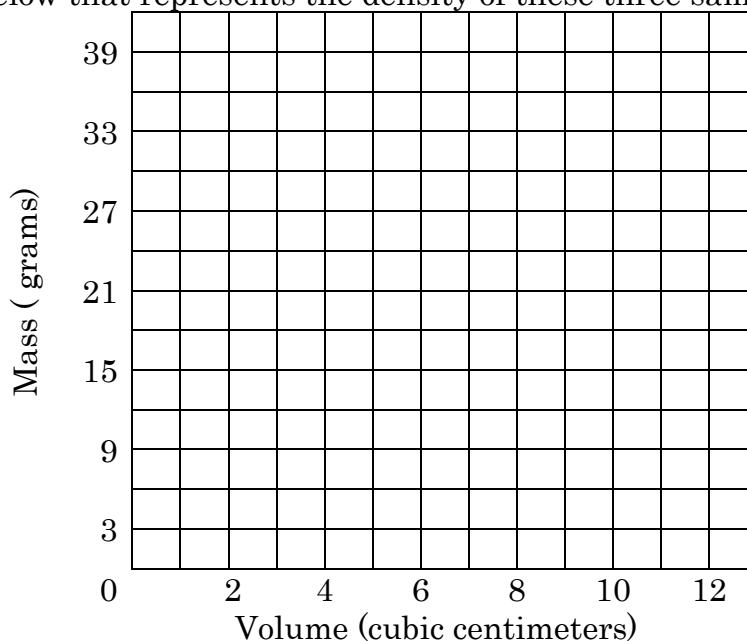
Problems: Answer the following questions for each sample below. Each sample is made of the same uniform material.

<p>Sample A</p> 	<p>Sample B</p> 	<p>Sample C</p> 
<p>Solve for the following. Show all work: write out the formula; substitute numbers; solve.</p>		
<p>1. Determine the volume of Sample A: $V = l \cdot w \cdot h$</p> <p>2. What is the density of Sample A?</p>	<p>3. Determine the volume of Sample B.</p> <p>4. What is the mass of Sample B?</p>	<p>5. What is the mass of Sample C?</p>

14. Fill in the chart below, using the values determined above.

Sample:	A	B	C
Mass (g)			
Volume (cm ³)			

15. Draw a graph below that represents the density of these three samples.

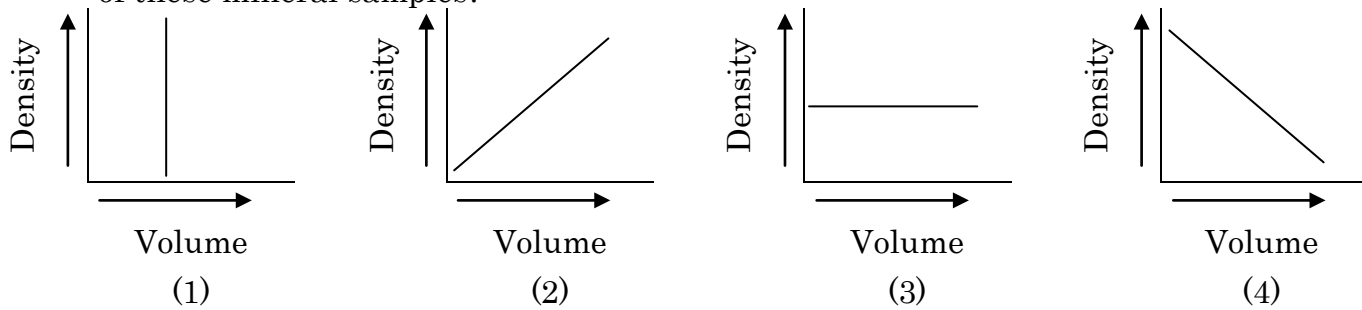


Base your answers to questions 16 and 17 on the data tables below. The data table below shows the mass and volume of three samples of the same mineral.

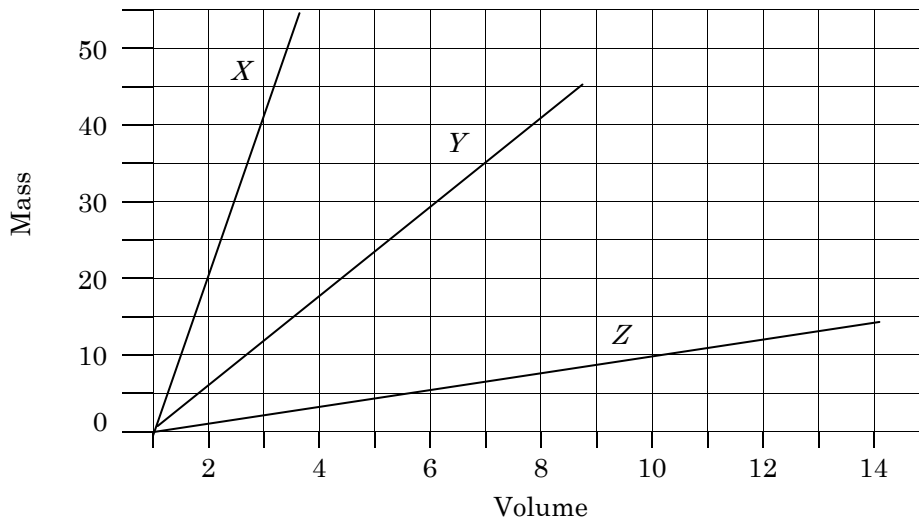
16. Determine the density of each of the samples below.

Sample	Mass (g)	Volume (cm ³)	Density (g/cm ³)
A	50	25	
B	100	50	
C	150	75	

17. Which graph best represents the relationship between the density and the volume of these mineral samples?



Base your answers to questions 18 through 20 on the graph below which shows the relationship between mass and volume for three materials X, Y, and Z which are at a temperature of 20°C.



18. What is the approximate density of material Y?

- (1) 1.0 g/cm³ (2) 0.2 g/cm³ (3) 5.0 g/cm³ (4) 10.0 g/cm³

19. When the volume of material Z is 14 cubic centimeters, its mass is

- (1) 8 g (2) 10 g (3) 14 g (4) 16 g

20. Using the graph above, draw the line graph on for a material that has a volume of 7 cubic centimeters and a mass of 12 grams.