MATH for SCIENCE
Density ~ Lesson Plan

I. Topic: Density ~

II. Goals/Objectives
- A. Students will learn the definition of and equation for density.
- B. Students will learn to calculate density problems.
- C. Students will learn to manipulate the density formula/equation to solve for either mass or volume as well as density.
- D. Students will learn the volume formulas for cylinders and prisms (rectangular solids).

III. National Education Standards:
- A. Mathematics.
  1. NM-ALG.9-12.2
     Represent and analyze situations and structures using algebraic symbols.
  2. NM-ALG.9-12.3
     Use mathematic models to represent and understand quantitative relationships.
  3. NM-ALG.9-12.4
     Analyze change in various contexts.
  4. NM-GEO.9-12.4
     Use visualization, special reasoning, and geometric modeling to solve problems.
  5. NM-MEA.9-12.1
     Understand measurable attributes of objects and the units, systems, and processes of measurement.
  6. NM-MEA.9-12.2
     Apply appropriate techniques, tools, and formulas to determine measurements.
  7. NM-PROB.PK-12.1
     Build new math knowledge through problem solving.
  8. NM-PROB.PK-12.2
     Solve problems that arise in mathematics and in other contexts.
  9. NM-PROB.PK-12.3
     Apply and adapt a variety of appropriate strategies to solve problems.
  10. NM-PROB.REA.PK-12.4
     Select and use various types of reasoning and methods of proof.
  11. NM-PROB.COMM.PK-12.2
     Communicate their mathematic thinking coherently and clearly to peers, teachers, and others.
  12. NM-PROB.CONN.PK-12.1
     Recognize and use connections among mathematic ideas.
  13. NM-PROB.CONN.PK-12.2
     Understand how mathematic ideas interconnect and build on one another to produce a coherent whole.
  14. NM-PROB.CONN.PK-12.3
     Recognize and apply mathematics in contexts outside of mathematics.

B. Science
1. Standard 8 – Understanding the structure and properties of matter
Benchmark 5
2. Standard 12 – Understanding the nature of scientific inquiry
Level III – Benchmarks 6 & 8
Level IV – Benchmark 4

IV. Materials:
A. Blackboard with colored chalk or whiteboard with colored markers and cleaner.
B. Overhead projector.
C. Clear projection sheets to make overhead sheets of the "Presentation Notes."
D. "Student Notes" copied for each student.
E. Pencils, colored pencils, & calculators.
F. Density Worksheet.

V. Presentation Outline:
A. Definition and equation.
B. Three equations to solve for all three components.
C. Examples.

VI. Presentation:
A. Use the presentation notes on an overhead projector, or
B. Use the power point presentation.

VII. Density Presentation: Student Notes ~
Students are to fill in the blank spaces in their notes during the presentation.

VIII. Independent Practice: Density Worksheet ~
A. Homework: #'s 1 – 15.
B. The homework should be due the next day.

IX. Evaluation/Assessment: Density Quiz ~
Have students take this quiz the next day after going over any questions from the homework.

MATH for SCIENCE
Density

I. Density Defined ~

A. Density is a **derived quantity** that relates a ratio of the mass of a substance to its unit volume.

B. The equation for this relationship is:

$$\text{Density} = \frac{\text{Mass of a substance}}{\text{Volume of a substance}} \qquad D = \frac{M}{V}$$

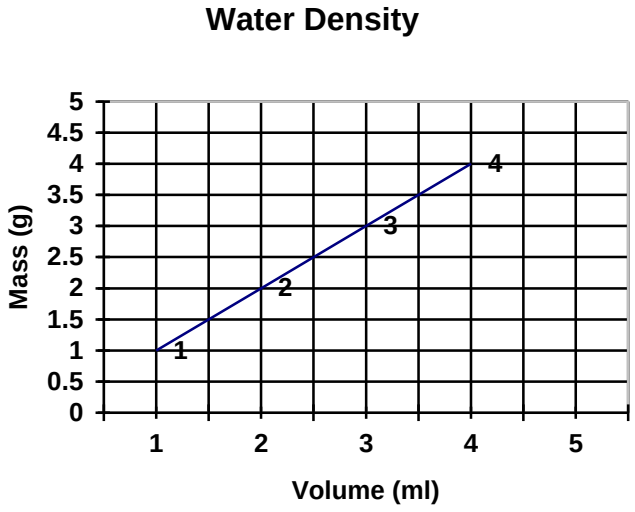
C. In chemistry, the commonly used units for mass are **grams (g)** and for volume are **centimeters cubed (cm^3).**

D. The SI units are **kilograms (kg)** for mass and meters **cubed (m^3)** for volume. These SI units are very large, so the smaller gram and cm^3 or ml units are used for everyday laboratory measurements and calculations.

E. In the metric system, **volume** can be expressed by **two** different sets of units; forms of liters or forms of meters cubed. For example, **1 milliliter (ml) = 1 centimeter cubed (cm^3).** These two units are interchangeable.

F. Mass and volume units are **directly** proportional.

1. This means whenever one of the units **increases**, so does the other one. Conversely, when one **decreases** so does the other.
2. For example, the graph below demonstrates that the **ratio** of mass/ volume **equals** the **slope** of the line. This slope is always **constant** for a specific substance regardless of the **mass** or **size** of the object.
3. This means the **density** is always the **same** for each specific substance. **Density** thus becomes a tool to **identify** what substance is present.



G. The **density equation** can be manipulated to solve for either mass or **volume**.

1. To solve for mass:
   a. **Multiply** both sides by volume (V). This will cancel the volume in the denominator.

$$\mathbf{V} * D = \frac{M}{\cancel{V}} * \cancel{V} \qquad V * D = M \qquad \text{or} \qquad \mathbf{M = V * D}$$

2. To solve for volume:
   a. **Multiply** both sides by volume (V), like you did in the previous step.

$$\mathbf{V} * D = \frac{M}{\cancel{V}} * \cancel{V} \qquad V * D = M$$

   b. **Divide** both sides by density (D). This will cancel the density on the left side of the equation, leaving volume (V) by its self.

$$V * \frac{\cancel{D}}{\cancel{D}} = \frac{M}{D} \qquad \mathbf{V = \frac{M}{D}}$$

3. The three resulting equations are:

$\mathbf{D = \frac{M}{V}}$	$\mathbf{M = V * D}$	$\mathbf{V = \frac{M}{D}}$
To find	To find	To find
Density	**Mass**	**Volume**

H. Examples.

1. A rod of iron measures 6.5 cm long, 2.2 cm wide, and 4.1 cm high. Find the rod's volume. If the iron rod weighs 461.4 grams, what is iron's density?
   a. V = ?
      L = 6.5 cm
      W = 2.2 cm
      H = 4.1 cm
      V = LWH
      V = (**6.5** cm)(**2.2** cm)(**4.1** cm)
      V = **58.63** cm^3
   b. D = ?
      M = 461.4 g
      V = **58.63 cm^3**
      $D = \frac{M}{V}$
      $D = \frac{461.4\ g}{\mathbf{58.63\ cm^3}}$
      D = **7.87g/cm^3**

2. A decorative copper pin displaced a volume of 3.5 cm^3. What's the pin's mass if copper's density is 8.92 g/cm^3?
   D = 8.92 g/cm^3
   M = ?
   V = 3.5 cm^3
   M = V * D
   $M = (\mathbf{3.5}\ \cancel{cm^3})(\frac{\mathbf{8.92}\ g}{1\ \cancel{cm^3}})$
   M = **31.22 g**

3. A sugar cube (sucrose) measuring 3.0 cm long by 1.5 cm wide by 1.0 cm high weighs 7.1 grams. What is the density of sugar?
   a. V = ?
      L = **3.0** cm
      W = **1.5** cm
      H = **1.0** cm
      V = LWH
      V = (**3.0** cm)(**1.5** cm)(**1.0** cm)
      V = **4.5** cm^3
   b. D = ?
      M = 7.1 g
      V = **4.5** cm^3
      $D = \frac{M}{V}$
      $D = \frac{7.1\ g}{\mathbf{4.5}\ cm^3}$
      D = **1.58** g/cm^3

4. A cylinder container filled with table salt (sodium chloride) has hardened. The cylinder has a diameter of 4 cm and a height of 8.5 cm. What is its volume? The density of table salt is 2.16 g/cm^3. Find the mass of the salt in the cylinder.

a. V = ? $\quad V = \pi r^2 h$
r = **2** cm $\quad V = (\mathbf{3.14})(\mathbf{2}\text{ cm})^2(\mathbf{8.5}\text{ cm})$
h = **8.5** cm $\quad V = \mathbf{106.8}\text{ cm}^3$
π = 3.14

b. D = 2.16 g/cm^3 $\quad M = V\,D$
M = ? $\quad M = (\mathbf{106.8}\ \cancel{\text{cm}}^3)\left(\frac{2.16\text{ g}}{1\ \cancel{\text{cm}}^3}\right) \quad M = \mathbf{230.6}\text{ g}$
V = **106.8** cm^3

5. Students in a lab were given 3 test tubes with clear liquid in each. The students were told to determine if the test tubes have the same or different substances. The liquid in each of the 3 test tubes was poured into 3 graduated cylinders. Liquid A measured 3.6 ml, liquid B measured 4.8 ml, and liquid C measured 4.1 ml. Then the students wanted to find out how much each liquid weighed. They had already weighed the empty graduated cylinders and each weighed 15.8 grams. The cylinder with liquid A weighed 20.6 grams. The cylinder with liquid B weighed 22.2 grams. The cylinder with liquid C weighed 22.9 grams. Now, calculate the density for each liquid to determine if the liquids are the same or different.

a. Liquid A
D = ?
M = 20.6 – 15.8 = **4.8** g
V = **3.6** ml

$D = \frac{M}{V} = \frac{\mathbf{4.8}\text{ g}}{\mathbf{3.6}\text{ ml}}$
D = **1.3** g/ml

b. Liquid B
D = ?
M = 22.2 – 15.8 = **6.4** g
V = **4.8** ml

$D = \frac{M}{V} = \frac{\mathbf{6.4}\text{ g}}{\mathbf{4.8}\text{ ml}}$
D = **1.3** g/ml

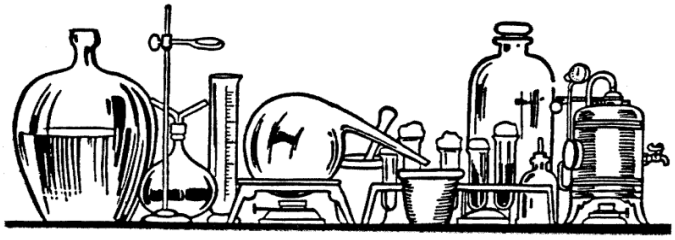
c. Liquid C
D = ?
M = 22.9 – 15.8 = **7.1g**
V = **4.1** ml

$D = \frac{M}{V} = \frac{\mathbf{7.1}\text{ g}}{\mathbf{4.1}\text{ ml}}$
D = **1.7** g/ml

Results: **Liquids A and B are the same, but liquid C is different.**

Note for Teachers:

The highlighted areas in the "Presentation" are the areas left blank in the "Student Notes." These highlighted areas act as the grading "key" for the "Student Notes." It is recommended that each word or number the student successfully records on his/her "Notes" sheets be given either one half (0.5) of a point or one point. Giving students points for recording important information encourages them to stay focused during class and helps to ensure that students have complete information to study.



Density ~ Student Notes

Name: _____ Date: _____ Grade: _____

I. Density Defined ~

A. Density is a _____ that relates a ratio of the mass of a substance to its unit volume.

B. The equation for this relationship is:

$$\text{Density} = \frac{\text{Mass of a substance}}{\text{Volume}} \qquad D = \frac{\quad}{\quad}$$

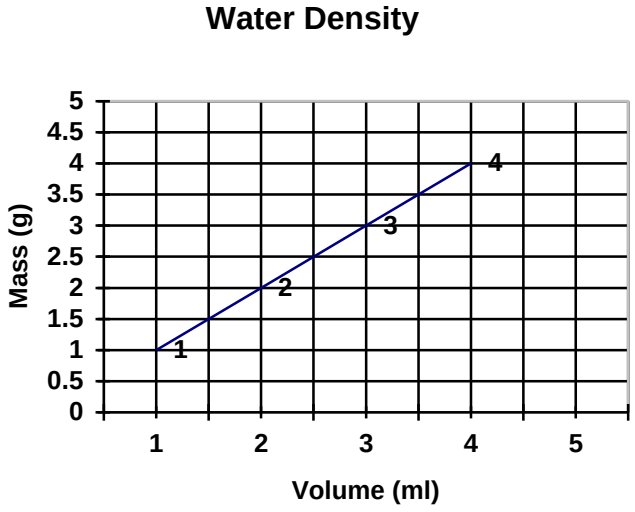
C. In chemistry, the commonly used units for mass are _____ and for volume are _____.

D. The SI units are _____ for mass and _____ for volume. These SI units are very large, so the smaller gram and cm^3 units are used for everyday laboratory measurements and calculations.

E. In the metric system, _____ can be expressed by _____ different sets of units; forms of liters or forms of meters cubed. For example, _____ = _____ . These two units are_____ .

F. Mass and volume units are _____ proportional.

1. This means whenever one of the units_____ , so does the other one. Conversely, when one _____ so does the other.
2. For example, the graph below demonstrates that the _____ of mass/ volume _____ the _____ of the line. This slope is always _____ for a specific substance regardless of the _____ or _____ of the object.
3. This means the _____ is always the _____ for each specific substance. _____ thus becomes a tool to _____ what substance is present.



G. The _____ can be manipulated to solve for either _____ or _____.

1. To solve for **mass**:
   a. _____ both sides by volume (V). This will cancel the volume in the denominator.

$$\mathbf{V} * D = \frac{M * \cancel{V}}{\cancel{V}} \qquad V * D = M \qquad \text{or} \qquad \mathbf{M = V * D}$$

2. To solve for **volume**:
   a. _____ both sides by volume (V), like you did in the previous step.

$$\mathbf{V} * D = \frac{M * \cancel{V}}{\cancel{V}} \qquad V * D = M$$

   b. _____ both sides by density (D). This will cancel the density on the left side of the equation, leaving volume (V) by its self.

$$V * \frac{\cancel{D}}{\cancel{D}} = \frac{M}{D} \qquad \mathbf{V = \frac{M}{D}}$$

3. The three resulting equations are:

$\mathbf{D = \frac{M}{V}}$	$\mathbf{M = V * D}$	$\mathbf{V = \frac{M}{D}}$
To find	To find	To find
Density	**Mass**	**Volume**

H. Examples.

1. A rod of iron measures 6.5 cm long, 2.2 cm wide, and 4.1 cm high. Find the rod's volume. If the iron rod weighs 461.4 grams, what is iron's density?
   a. V = ?
      L = 6.5 cm
      W = 2.2 cm
      H = 4.1 cm
      V = LWH
      V = (_____ cm)(_____ cm)(_____ cm)
      V = _____ cm^3
   b. D = ?
      M = 461.4 g
      V = 58.63 cm^3
      $D = \frac{M}{V}$ $D = \frac{\_\_\_\_g}{cm^3}$ D = ___g/cm^3

2. A decorative copper pin displaced a volume of 3.5 cm^3. What's this pin's mass given copper's density is 8.92 g/cm^3?
   D = 8.92 g/cm^3
   M = ?
   V = 3.5 cm^3
   M = V * D
   M = (_____ $\cancel{cm}^3$)(_____g) / (1 $\cancel{cm}^3$)
   M = _____ g

3. A sugar cube (sucrose) measuring 3.0 cm long by 1.5 cm wide by 1.0 cm high weighs 7.1 grams. What is the density of sugar?
   a. V = ?
      L = _____ cm
      W = _____cm
      H = _____ cm
      V = LWH
      V = (_____ cm)(_____ cm)(_____cm)
      V = _____ cm^3
   b. D = ?
      M = _____ g
      V = _____ cm^3
      $D = \frac{M}{V}$ $D = \frac{\_\_\_\_g}{cm^3}$
      D = _____ g/cm^3

4. A cylinder container filled with table salt (sodium chloride) has hardened. The cylinder has a diameter of 4 cm and a height of 8.5 cm. What is its volume? The density of table salt is 2.16 g/cm^3. Find the mass of the salt in the cylinder.

a. V = ?
r = 2 cm
h = 8.5 cm
π = 3.14

V = $\pi r^2 h$
V = (_____)(_____ cm)^2(_____ cm)
V = _____ cm^3

b. D = _____ g/cm^3
M = ?
V = _____ cm^3

M = V D
M = (_____ ~~cm^3~~)(_____g) / ~~cm^3~~
M = _____ g

5. Students in a lab were given 3 test tubes with clear liquid in each. The students were told to determine if the test tubes have the same or different substances. The liquid in each of the 3 test tubes was poured into 3 graduated cylinders. Liquid A measured 3.6 ml, liquid B measured 4.8 ml, and liquid C measured 4.1 ml. Then the students wanted to find out how much each liquid weighed. They had already weighed the empty graduated cylinders and each weighed 15.8 grams. The cylinder with liquid A weighed 20.6 grams. The cylinder with liquid B weighed 22.2 grams. The cylinder with liquid C weighed 22.9 grams. Now, calculate the density for each liquid to determine if the liquids are the same or different.

a. Liquid A
D = ?
M = 20.6 – 15.8 = _____ g
V = _____ ml

D = $\frac{M}{V}$ = _____g / ml
D = _____ g/ml

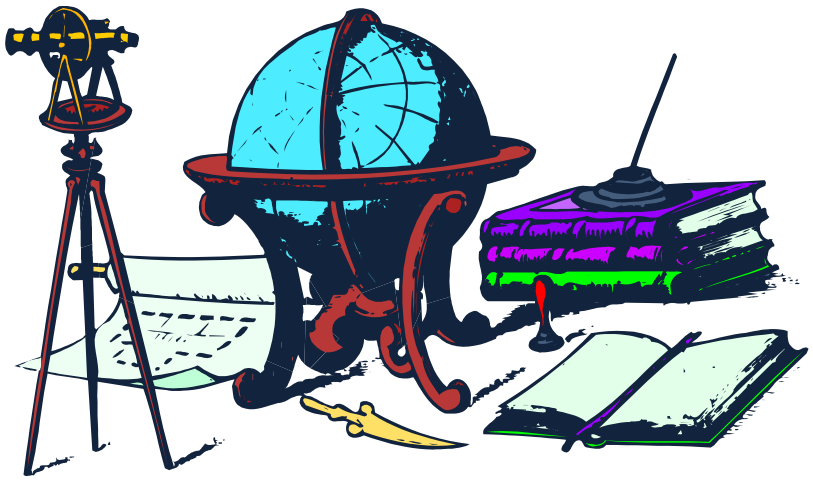
b. Liquid B
D = ?
M = 22.2 – 15.8 = _____
V = _____ ml

D = $\frac{M}{V}$ = _____g / ml
D = _____ g/ml

c. Liquid C
D = ?
M = 22.9 – 15.8 = _____g
V = _____ ml

D = $\frac{M}{V}$ = _____g / ml
D = _____ g/ml

Results: _____.



Density Worksheet

Name: _____ Date: _____ Grade: _____

Complete the following table by solving for the missing values of either mass, volume, or density. Attach all work.

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#	Mass	Volume	Density
1.	53.8g	13.4 ml	
2.	23.6 g		2.74 g/ml
3.		2.14 ml	2.13 g/ml
4.	378.52 g		9.91 g/ml
5.	81.34 g	16.92 ml	
6.		6.98 ml	0.97 g/ml
7.	18.5 g		1.35 g/ml
8.	46.75 g	32.16 ml	
9.		27.5 ml	3.62 g/ml
10.	62.48 g		5.88 g/ml
11.	126.73 g	85.40 ml	

12. A nugget of gold looking material was found by a swimmer in Lake Tahoe. It weighed 90.7 grams. They tested the nugget's volume using water displacement. The initial volume of the water alone was 40 ml. The nugget was added to the water, which made the water volume increase to 44.7 ml. If gold's density is 19.3 g/ml, was this a nugget of real gold or fool's gold?

13. A bag with copper looking coins is found buried in a box. The coins are taken out and weighed. They weigh 225 grams. The coins are put into a cylinder with 50 ml of water. The water level rises to 73.5 ml. Are these coins really copper? Copper's density is 8.92 g/ml.

14. Students are given a cube of an unknown white substance. They are told it is one of two substances; sucrose (table sugar) or sodium bicarbonate (baking soda). Students must find the density of the substance to decide its identity. The cube measures 4.7 cm long, 2.2 cm high, and 3.0 cm wide. The cube weighs 67 grams. The densities are: Sucrose – 1.58 g/ml; sodium bicarbonate – 2.16 g/ml.

15. A cylinder with a diameter of 8 cm is filled to a height of 6 cm with liquid benzene. If benzene has a density of 0.8787 g/ml, how much should the liquid weigh?

Density Worksheet
Answer Key

Name: _____ **Date:** _____ **Grade:** _____

Complete the following table by solving for the missing values for mass, volume, or density. Attach all Work.

#	Mass	Volume	Density
1.	53.8g	13.4 ml	**4.0 g/ml**
2.	23.6 g	**8.6 ml**	2.74 g/ml
3.	**4.56 g**	2.14 ml	2.13 g/ml
4.	378.52 g	**38.2 ml**	9.91 g/ml
5.	81.34 g	16.92 ml	**4.81 g/ml**
6.	**6.78 g**	6.98 ml	0.97 g/ml
7.	18.5 g	**13.7 ml**	1.35 g/ml
8.	46.75 g	32.16 ml	**1.45 g/ml**
9.	**99.55 g**	27.5 ml	3.62 g/ml
10.	62.48 g	**10.63 ml**	5.88 g/ml
11.	126.73 g	85.40 ml	**1.48 g/ml**

12. A nugget of gold looking material was found by a swimmer in Lake Tahoe. It weighed 90.7 grams. When they tested the volume using water displacement, the initial volume of water alone was 40 ml. The nugget was added to the water, which made the water volume increase to 44.7 ml. If gold's density is 19.3 g/ml, was this a nugget of real gold or fool's gold?

Vol. of water + nugget 44.7 ml
- Vol. of water - 40.0 ml
Vol. of nugget 4.7 ml

D = M = 90.7 g
V 4.7 ml
D = 19.298 g/ml

Yes, this was real gold.
D = 19.3 g/ml

13. A bag with copper looking coins is found buried in a box. The coins are taken out and weighed. They weigh 225 grams. The coins are put into a cylinder with 50 ml of water. The water level rises to 73.5 ml. Are these coins really copper? Copper's density is 8.92 g/ml.

Vol. of water + coins 73.5 ml
- Vol. of water - 50.0 ml
Vol. of coins 23.5 ml

D = M = 225 g
V 23.5 ml
D = 9.57 g/ml

No, these coins are not copper.

14. Students are given a cube of an unknown white substance. They are told it is one of two substances; sucrose (table sugar) or sodium bicarbonate (baking soda). Students must find the density of the substance to decide its identity. The cube measures 4.7 cm long, 2.2 cm high, and 3.0 cm wide. The cube weighs 67 grams. The densities are: Sucrose – 1.58 g/ml; sodium bicarbonate – 2.16 g/ml.

L = 4.7 cm
W = 3.0 cm
H = 2.2 cm

V = LxWxH
V = (4.7 cm)(3.0 cm)(2.2 cm)
V = 31.0 cm^3

D = M = 67 g
V 31 cm^3
D = 2.16 g/cm^3

The substance is: Sodium Bicarbonate

15. A cylinder with a diameter of 8 cm is filled to a height of 6 cm with liquid benzene. If benzene has a density of 0.8787 g/ml, how much should it weigh?

r = 4 cm
h = 6 cm
π = 3.14

$V = \pi r^2 h$
V = (3.14)(4 cm)^2(6 cm)
V = 301.44 cm^3

V = 301.44 cm^3
D = 0.8787 g/cm^3
M = ?

M = V x D
M = (301.44 cm^3)(0.8787 g) / 1 cm^3
M = 264.88 g = 264.9 g

1. M = 53.8 g D = $\frac{M}{V}$ = $\frac{53.8\ g}{13.4\ cm^3}$
V = 13.4 cm^3 **D = 4.01 g/cm^3**
D = ?

2. M = 23.6 g V = $\frac{M}{D}$ = $\frac{23.6\ g}{2.74\ g/cm^3}$
V = ? **V = 8.61 cm^3**
D = 2.74 g/cm^3

3. M = ? M = D V
V = 2.14 cm^3 M = 2.13 g/cm^3 x 2.14 cm^3
D = 2.13 g/cm^3 **M = 4.56 g**

4. M = 81.34 g D = $\frac{M}{V}$ = $\frac{81.34\ g}{16.92\ cm^3}$
V = 16.92 cm^3 **D = 4.81 g/cm^3**
D = ?

5. M = 378.52 g V = $\frac{M}{D}$ = $\frac{378.52\ g}{9.91\ g/cm^3}$
V = ? **V = 38.2 cm^3**
D = 9.91 g/cm^3

6. M = ? M = D V
V = 6.98 cm^3 M = 0.97 g/cm^3 x 6.98 cm^3
D = 0.97 g/cm^3 **M = 6.78 g**

7. M = 18.5 g V = $\frac{M}{D}$ = $\frac{18.5\ g}{1.35\ g/cm^3}$
V = ? **V = 13.7 cm^3**
D = 1.35 g/cm^3

8. M = 46.75 g D = $\frac{M}{V}$ = $\frac{46.75\ g}{32.16\ cm^3}$
V = 32.16 cm^3 **D = 1.45 g/cm^3**
D = ?

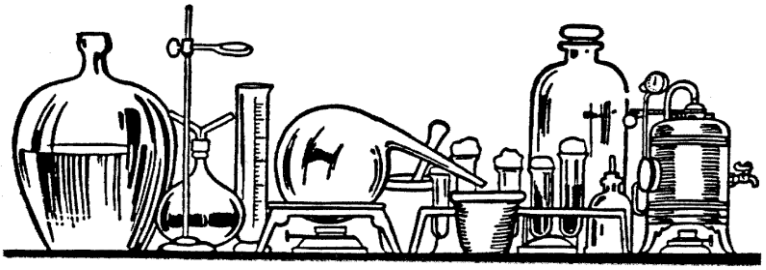
9. M = ? M = D V
V = 27.5 cm^3 M = 3.62 g/cm^3 x 27.5 cm^3
D = 3.62 g/cm^3 **M = 99.55 g**

10. M = 62.48 g V = $\frac{M}{D}$ = $\frac{126.73\ g}{5.88\ g/cm^3}$
V = ? **V = 10.63 cm^3**
D = 5.88 g/cm^3

11. M = 126.73 g D = $\frac{M}{V}$ = $\frac{126.73\ g}{85.40\ cm^3}$
V = 85.40 cm^3 **D = 1.48 g/cm^3**
D = ?

Grading Rubric for Density Worksheet: 52/50 Points

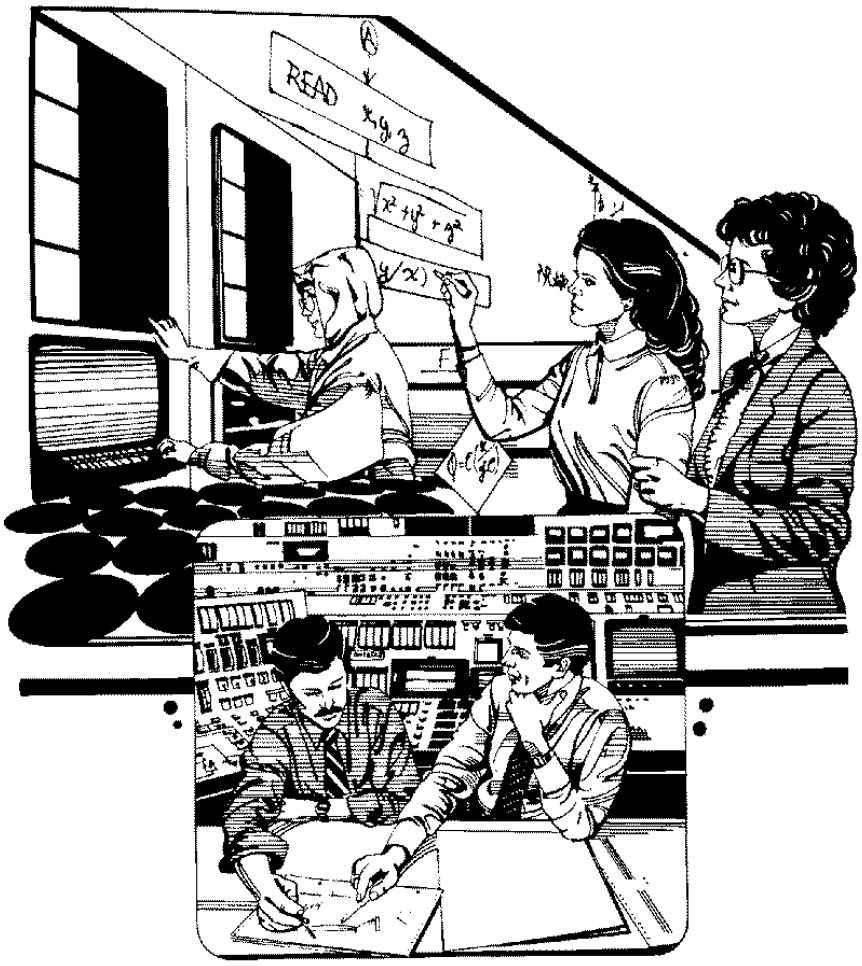
Problems	Correct Equation (1 pt each)	Correctly Identify M,V, or D Components (0.5 pt each)	Correct Answer (1 pt each)	Total Points (3 pts each) (33 pts Possible)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				



Problems	Calculate Correct Vol. (1 pt each)	Correct Equation (1 pt each)	Correct Calculations (1 pt each)	Correct Answer to Question (1 pt)	Total Points (4 pts each) (8 pts Possible)
12.					
13.					

Problem	Correct Vol. Equation (1 pt)	Correct Vol. Calculation (1 pt)	Correct Formula (1 pt)	Correct Calculation (1 pt)	Correct Answer (1 pt)	Total Points (5 pts Possible)
14.						

Problem	Correct Vol. Equation (1 pt)	Correct ID Components of Equation (1 pt)	Correct Calculation Volume (1 pt)	Correct Equation for Mass (1 pt)	Correct Substitution & Calculation (1 pt)	Correct Answer (1 pt)	Total Points (6 pts Possible)
15.							



Density Quiz

Name: _____ Date: _____ Grade: _____

Complete the chart by solving for the missing data. Show all work.

#	Mass	Volume	Density
1.	250 g	300 ml	
2.		120 ml	1.43 g/ml
3.	65 g		2.68 g/ml
4.	620 g	535 ml	
5.		47.26 ml	9.81 g/ml
6.	137.4 g		5.24 g/ml
7.	48.5 g	65.5 ml	

8. Students were given a block of salt. They were told to find its volume and mass. After carefully measuring the block's dimensions at 15 cm long by 8 cm wide by 12 cm high, they put the block in water. Suddenly, they remembered they were supposed to weigh the block BEFORE they put it in the water. How can they still find the mass of the block even though it is dissolving in the pot of water? (Hint: Salt's density is 2.16g/cm^3.) Find the mass.

9. Students are given a solid, black cylinder and asked to determine if it is iron or some other metal. The cylinder has a diameter of 3 cm and a height of 7 cm. The cylinder weighs 400 g. Iron's density is 7.87 g/cm^3.

10. Students are given 2 tiny blocks of white substances. They must determine which block is sugar (sucrose), which has a density of 1.58 g/cm^3, and which is salt (sodium chloride), which has a density of 2.16 g/cm^3. Block A measures 3 cm long by 1.5 cm wide by 4 cm high and weighs 28.5 g. Block B measures 2.5 cm long by 2 cm wide by 3 cm high and weighs 32.4 g.

Density Quiz
Answer Key

Name: _____ **Date:** _____ **Grade:** _____

Complete the chart by solving for the missing data. Show all work. Show all work.

#	Mass	Volume	Density
1.	250 g	300 ml	**0.83 g/ml**
2.	**171.6 g**	120 ml	1.43 g/ml
3.	65 g	**24.25 ml**	2.68 g/ml
4.	620 g	535 ml	**1.16 g/ml**
5.	**463.62 g**	47.26 ml	9.81 g/ml
6.	137.4 g	**26.22 ml**	5.24 g/ml
7.	48.5 g	65.5 ml	**0.74 g/ml**

8. Students are given a block of salt. They were told to find its volume and mass. After carefully measuring the block's dimensions at, 15 cm long by 8 cm wide by 12 cm high, they put the block in water. Suddenly, they remembered they were supposed to weigh the block BEFORE they put it in the water. How can they still find the mass of the block even though it is dissolving in the pot of water? (Hint: salt's density is 2.16 g/cm^3.) Find the mass.

L = 15 cm V = LWH M = ? M = D V
W = 8 cm V = (15 cm)(8 cm)(12 cm) V = 1440 cm^3 M = (2.16 g/cm^3)(1440 cm^3)
H = 12 cm **V = 1440 cm^3** D = 2.16 g/cm^3 **M = 3,110.4 g/cm^3**

9. Students are given a solid, black cylinder and asked to determine if it is iron or some other metal. The cylinder has a diameter of 3 cm and a height of 7 cm. The cylinder weighs 400 g. Iron's density is 7.87 g/cm^3. d = 3 so r = 1.5

r = 1.5 cm V = $\pi r^2 h$ M = 400 g D = $\frac{M}{V} = \frac{400\text{ g}}{49.455\text{ cm}^3}$
h = 7 cm V = (3.14)(1.5 cm)^2(7 cm) V = 49.455 cm^3
π = 3.14 **V = 49.455 cm^3** D = ? **D = 8.09 g/cm^3**
No, this cylinder is not iron because its density is different.

10. Students are given 2 tiny blocks of white substances. They must determine which block is sugar (sucrose), which has a density of 1.58 g/cm^3, and which is salt (sodium chloride), which has a density of 2.16 g/cm^3. Block A measures 3 cm long by 1.5 cm wide by 4 cm high and weighs 28.5 g. Block B measures 2.5 cm long by 2 cm wide by 3 cm high and weighs 32.4 g.

Block A Block B
L = 3 cm V = LWH L = 2.5 cm V = LWH
W = 1.5 cm V = (3 cm)(1.5 cm)(4 cm) W = 2 cm V = (2.5 cm)(2 cm)(3 cm)
H = 4 cm **V = 18 cm^3** H = 3 cm **V = 15 cm^3**

M = 28.5 g D = $\frac{M}{V} = \frac{28.5\text{ g}}{18\text{ cm}^3}$ M = 32.4 g D = $\frac{M}{V} = \frac{32.4\text{ g}}{15\text{ cm}^3}$
V = 18 cm^3 V = 15 cm^3
D = ? **D = 1.58 g/cm^3** D = ? **D = 2.16 g/cm^3**
Block A is sugar (sucrose). **Block B is salt (sodium chloride).**

1. M = 250 g D = M = 250 g
   V = 300 ml V 300 ml
   D = ? **D = 0.83 g/ml**

2. M = ? M = D V
   V = 120 ml M = 1.43 g/ml x 120 ml
   D = 1.43 g/ml **M = 171.6 g**

3. M = 65 g V = M = 65 g
   V = ? D 2.68 g/ml
   D = 2.68 g/ml **V = 24.25 ml**

4. M = 620 g D = M = 620 g
   V = 535 ml V 535 ml
   D = ? **D = 1.16 g/ml**

5. M = ? M = D V
   V = 47.26 ml M = 9.81 g/ml x 47.26 ml
   D = 9.81 g/ml **M = 463.62 g**

6. M = 137.4 g V = M = 137.4 g
   V = ? D 5.24 g/ml
   D = 5.24 g/ml **V = 26.22 ml**

7. M = 48.5 g D = M = 48.5 g
   V = 65.5 ml V 65.5 ml
   D = ? **D = 0.74 g/ml**

Quiz Grading Rubric: 42/40 points

Problems	Correct Equation (1 pt each)	Correctly Identify M,V, or D Components (.5 pts each)	Correct Answer (1 pt each)	Total Points (3 pts each) (21 pts Possible)
1.				
2.				
3.				
4.				
5.				
6.				
7.				

Problem	Correct Vol. Equation (1 pt)	Correct Vol. Calculation (1 pt)	Correct Formula (1 pt)	Correct Calculation (1 pt)	Correct Answer (1 pt)	Total Points (5 pts Possible)
8.						

Problem	Correct Vol. Equation (1 pt)	Correct ID Components of Equation (1 pt)	Correct Calculation Volume (1 pt)	Correct Equation for Mass (1 pt)	Correct Substitution & Calculation (1 pt)	Correct Answer (1 pt)	Total Points (6 pts Possible)
9.							

Problem	Correct Vol. Equation (1 pt each)	Correct Vol. Calculation (1 pt each)	Correct Formula (1 pt each)	Correct Calculation (1 pt each)	Correct Identity (1 pt each)	Total Points (5 pts each) (10 pts Possible)
10 a.						
10 b.						