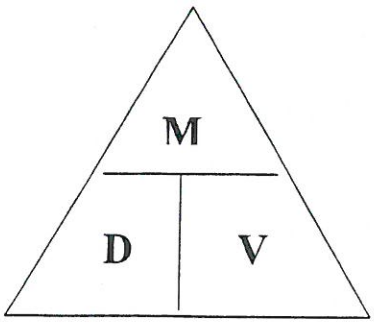
Name: Ms. GB

Density Worksheet

Remember:



Sample Problem #1:

What is the density of an object whose mass is 15 g and whose volume is 3 ml?

Step 1: Decide what type of information the problem gives us.

D= ? (In this problem we want to know this.)
M= 15 g (Any time you see milligrams(mg), grams(g) or kilograms(kg) it means mass.)
V= 3 ml (Any time you see centimeters(cm), milliliters(mL) or liters(L) it, means volume.)

Step 2: Look at the triangle and cover the letter you are missing.

In this problem you are missing density so you cover density. This leaves you with mass on top of volume. So your formula for density will look like this:

$$D=\frac{M}{V}$$

Step 3: Plug in the number you do have and do the math.

$$D=\frac{15\ g}{3\ mL}$$ (This means that you will divide: 15 g ÷ 3 mL)

D= 5 g/mL

You must put the units at the end, you get the units by looking at the formula. Just look at what I circled.

Questions:

1. What is the density of a ball that has a mass of 10 g and a volume of 5 cm^3?

$$D = \frac{M}{V} = 2\ g/cm^3$$

2. A rock has a mass of 12 g and a volume of 4 mL. What is it's density?

$$D = \frac{M}{V} = \frac{12g}{4ml} = 3\ g/ml$$

3. What is the density of a diamond whose mass is 6 g and has a volume of 2 cm^3?

$$D = \frac{M}{V} = \frac{6g}{2cm^3} = 3\ g/cm^3$$

Sample question #2:

What is the mass of a rock whose volume is 4 mL and has a density of 3 g/mL?

Step 1: Decide what type of information you have.

D= 3 g/mL (Remember that density can have several different units but it will always be a combination of a mass unit and a volume unit. Any number with a "/" in it.)

M= ?

V= 4 mL

Step 2: Look at the triangle and cover the letter you are missing.

We know we are missing the M, so we will cover it and we are left with D beside V. So the equation to find mass is:

M= D x V

Step 3: Plug in the numbers that you know:

M= 3 g/mL x 4 mL

M= 12 g

I know that the mass is measured in grams because the units of density had "**g**"/mL. Mass is almost always measured in grams for this class.

Questions:

4. What is mass of 10 cm^3 of copper if it has a density of 8.3 g/cm^3?

$M = D \times V = 8.3\ g/cm^3 \times 10\ cm^3 = 83\ g$

5. Gold has a density of 19.3 g/mL. If you have 5 mL of gold what is the mass of your gold?

$M = D \times V = \frac{19.3\ g}{mL} \times 5\ mL = 96.5\ g$

6. You have 20 L of gas in a balloon. You know the gas has a density of 1.29 g/L, what is the mass of the gas in the balloon?

$M = D \times V = \frac{1.29\ g}{L} \times 20\ L = 25.8\ g.$

Sample Question #3:

What is the volume of a rock whose density is 1.74 g/cm^3 and has a mass of 8.7 g?

Step 1: Decide what type of information the problem gives you.

D= 1.74 g/cm^3
M= 8.7 g
V= ?

Step 2: Look at the triangle and cover the letter you are missing.

You know you are missing V so when you cover it you are left with M on top of D. So the formula for V is:

$V = \frac{M}{D}$

Step 3: Plug in the numbers you have:

$V = \frac{8.7\ g}{1.74\ g/cm^3}$ (This means 8.7 g ÷ 1.74 g/cm^3)

$V = 5\ cm^3$

I know that the units of volume are cm^3 because it appears in the density units. In this class volume can be measure in cm^3, mL or L so be careful.

Questions:

7. What is the volume of a ball that has a mass of 16 g and a density of 0.5 g/mL?

$$V = \frac{m}{D} = \frac{16\,g}{0.5\,g/ml} = 32\,ml$$

8. You have a glass of sprit. The sprite has a mass of 80 g and has a density of 1.2 g/mL, what is the volume of sprite you have?

$$V = \frac{m}{D} = \frac{80\,g}{1.2\,g/ml} = 66.7\,ml$$

9. You fill a balloon with 10 g of a gas whose density is 0.089 g/L. What is the volume of the gas?

$$V = \frac{m}{D} = \frac{10\,g}{0.089\,g/L} = 112.4\,L.$$

Density HW Sheet Answers

1. a) Density is mass over volume.
   b) Every substance has its own density. Density can identify a substance.

2. The mass and the volume of the rock.

3. a) solid – g/cm^3 or g/ml or g/L liquid – g/ml or g/L
   b) kg/L or kg/cm^3

4. 

   - $D = \frac{m}{V}$
   - $D = \frac{5.680g}{1cm^3}$
   - $\boxed{D = 5.68g/cm^3}$

5. - $D = \frac{m}{V}$
   - $D = \frac{2.7g}{1cm^3}$
   - $\boxed{D = 2.7g/cm^3}$

6. - $5.68g/cm^3 - 2.7g/cm^3$
   $= \boxed{2.98g/cm^3 \text{ more dense}}$

7. 

   $m = D \times V$
   - $m = 7.9g/\cancel{cm^3} \times 1\cancel{cm^3}$
   - $\boxed{m = 7.9g}$

8. 

   - $V = \frac{m}{D}$
   - $V = \frac{8.9\cancel{g}}{8.9\cancel{g}/cm^3}$
   - $\boxed{V = 1cm^3}$

9. - $D = \frac{m}{V}$
   - $D = \frac{8.18g}{3.5ml}$
   - $\boxed{D = 2.34g/ml}$

10. $V = \frac{m}{D}$

- $V = \frac{125\,g}{7860\,g/L}$
- $V = 0.016\,L$

11. $m = D \times V$

$m = 96\,g/L \times 0.2\,L$

* Volume must be in L.

so

$200\,ml \div 1000 = 0.2\,L$

$m = 96\,g/L \times 0.2\,L$

$m = 192.2\,g$

12. $V = \frac{m}{D}$

$V = \frac{46\,g}{789\,g/L}$

$V = 0.058\,L$

13. $m = D \times V$

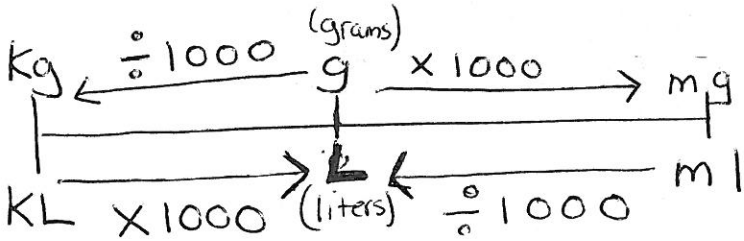
$m = 0.900\,g/L \times 22.4\,L$

$m = 20.16\,g$

* Remember ... your mass (m) and volume (V) must always be in the same units shown in your density.

ex: $D = 10\,g/L$ $m = ?$ $V = 2000\,ml$

↳ needs to change to liters.



so

$2000\,ml \div 1000 = 2\,L$

- $m = D \times V$
- $m = 10\,g/L \times 2\,L$
- $m = 20\,g$

Answer Sheet

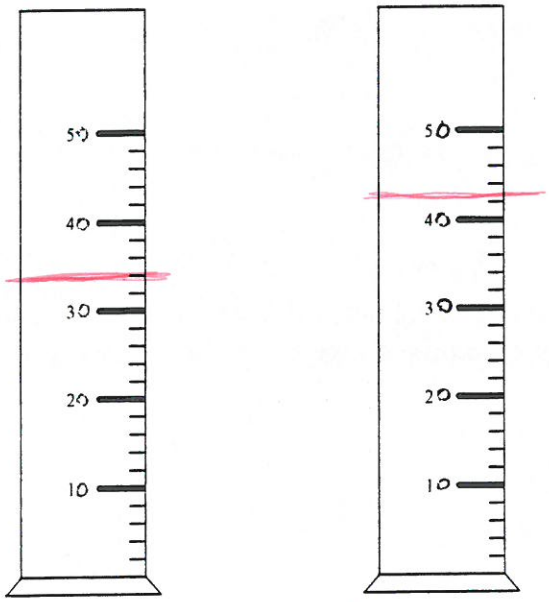
Mass, Volume and Density

1. What is the mass of a liquid if a student recorded the following information in the lab:

Mass of empty graduated cylinder:	23.7 g
Mass of graduated cylinder and liquid:	45.6 g
Volume of the liquid:	26.7 mL

45.6 - 23.7 = 21.9 g.

2. The following is a graduated cylinder that has 34 mL of water in it:



Before After

You then drop a solid into the graduated cylinder. The solid has a volume of 9 mL. Draw the level of the water before and after the solid is dropped in.

3. How would you find the mass of a solid?

Take a 100 ml graduated cylinder, fill it 1/2 way (50 ml). Gently Turn on electronic balance & zero it. Place the solid on it. Record mass

4. How would you find the volume of a solid?

Water displacement: Take a 100 ml graduated cylinder, fill it 1/2 way (50 ml) Gently place the solid inside. Record final volume (V_F) V_I (initial volume)

Now. $V_{solid} = V_F - V_I$.

5. How would you find the mass of a liquid?

Take an empty graduated cylinder, turn on balance & zero it. Place it on balance and record (M_I). Pour some of the unknown liquid into the graduated cylinder. Put this on the zeroed balance & record (M_F). Now.

Mass Liquid = $M_F - M_I$

6. How would you find the volume of a liquid?

Place liquid inside the graduated cylinder and record the volume

7. What is mass?

The amount of matter in a body

8. What is mass measured in?

*grams ; kilograms , tonnes

9. What is volume?

the amount of space a body occuppies

10. What is volume measured in?

milliliters or liters, cm^3, m^3

11. What is density? (ml) or (L)

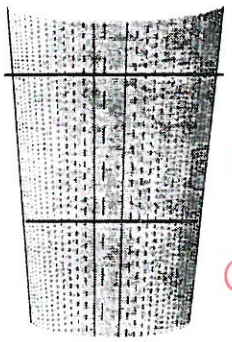
The amount of mass in a given unit volume

12. What is density measured in?

g/L , g/ml , kg/L , g/cm^3.

13. You have three different substances, using density determine the order that these three substances will appear if they were mixed together in the following container:

Substance A	1 g/mL
Substance B	0.95 g/mL
Substance C	2 g/mL



14. Why does a hot air balloon rise?

The hot air has a lower density than the surrounding air, therefore it rises.

5. A metal block that measures 3 cm on each side has a mass of 0.51 kg. What pure substance is the cube made of? Refer to Table 3 on page 235 of the student textbook.

Formula	Data	Calculation
$\rho = \frac{m}{V}$	$m = 510\ g$ $V = (3 \times 3 \times 3)\ cm^3$ $= 27\ cm^3$	$\rho = \frac{510\ g}{27\ cm^3}$ $\rho = 18.9\ g/cm^3$

Answer: *It is made of gold.*

6. Explain why a cork stopper floats on water. Refer to Tables 3 and 4 on page 235 of the student textbook.

With a density of 0.24 g/cm³, the cork stopper is less dense than water, which has a density of 1 g/mL or 1 g/cm³. As a result, the cork floats on water.

7. During a laboratory experiment, you are given two differently shaped solids that have different weights. You make the following measurements and observations:

	Solid A	Solid B
Shape	Spherical	Cylindrical
Mass	39.50 g	59.25 g
Initial volume of the water in the graduated cylinder	30.0 mL	30.0 mL
Final volume of the water (with the solid) in the graduated cylinder	35.0 mL	37.5 mL

Are the two solids made of the same pure substance? Explain your answer.

Formula	Data	Calculation
$\rho = \frac{m}{V}$	Solid A: $m = 3.50\ g$ $V = 5\ mL$	$\rho = \frac{39.50\ g}{5\ mL} = 7.9\ g/mL$
	Solid B: $m = 59.25\ g$ $V = 7.5\ mL$	$\rho = \frac{59.25\ g}{7.5\ mL} = 7.9\ g/mL$

Answer: *Yes, because the two solids have the same density.*

Chapter 3 • The Material World
Section 2 • Properties of Matter, pp. 244–249

Calculating Concentration

1. Determine the concentrations of the following solutions in g/L:

a) 30 g of solute in 2.5 L of solution

$C = \frac{m}{V} = \frac{30\ g}{2.5\ L}$

Answer: *12 g/L*

b) 14 g of solute in 250 mL of solution

$C = \frac{m}{V} = \frac{14\ g}{0.25\ L}$

Answer: *56 g/L*

2. Determine the concentrations of the following solutions in % m/V:

a) 1.5 g of solute in 60 mL of solution

$C\ (\%\ m/V) = \frac{m}{V} \times 100$

$\frac{1.5\ g \times 100}{60\ mL}$

Answer: *2.5% m/V*

b) 90 g of solute in 1.5 L of solution

$C\ (\%\ m/V) = \frac{m}{V} \times 100$

$\frac{90\ g \times 100}{1500\ mL}$

Answer: *6% m/V*

3. Convert the following concentrations:

a) 27 mL/L into % V/V

$\frac{27\ mL}{1000\ mL} = \frac{x}{100\ mL}$

$x = \frac{27\ mL \times 100\ mL}{1000\ mL}$ $x = 2.7\ mL/100\ mL$

Answer: *2.7% V/V*

b) 18% m/V into g/L

$\frac{18\ g}{100\ mL} = \frac{x}{1000\ mL}$

$x = \frac{18\ mL \times 1000\ mL}{100\ mL}$ $x = 180\ g/1000\ mL$

Answer: *180 g/L*

4. Calculate the volume of the solute needed to obtain the following solutions:

a) 500 mL of solution at 15% m/V

$\frac{15\ g}{100\ mL} = \frac{x}{500\ mL}$

$x = \frac{15\ g \times 500\ mL}{100\ mL}$

Answer: *75 g*

b) 35 mL of solution at 50 g/L

$\frac{50\ g}{1000\ mL} = \frac{x}{35\ mL}$

$x = \frac{50\ g \times 35\ mL}{1000\ mL}$

Answer: *1.75 g*

Answers to Density worksheet - Gr. 9

ANSWER KEY — APPLICATION A1

Chapter 2 • The Living World
Section 2 • Nutrition, pp. 105–106

Compatibility of Blood Types

1. True or false?

	True	False
a) A person with blood type A+ can give blood to a person with type B+.	☐	☑
b) A person with blood type O– can give blood to a person with type O+.	☑	☐
c) A person with type AB– can give blood to a person with type B–.	☐	☑
d) A person with type B– can give blood to a person with O+.	☐	☑
e) A person with type AB– can receive blood from a person with A–.	☑	☐

2. Fill in the following table by putting an "X" in the boxes where the types are compatible:

Can give to →	O–	AB+	B–	A+	O+
B+		X			
AB–		X			
A+		X		X	
O+		X		X	X
O–	X	X	X	X	X

3. Indicate the blood type(s) that:

a) can give blood to people with
1) AB–: *A–, B–, O– and AB–*
2) B+: *B+, B–, O–, O+*
3) O+: *O+, O–*
4) A–: *A–, O–*

b) can receive blood from people with
1) A+: *A+, AB+*
2) O+: *A+, B+, AB+, O+*
3) AB+: *AB+*
4) B–: *AB–, AB+, B–, B+*

4. One of these four people is type B–, one is type AB–, one is type AB+ and one is O+. Using information from the table on the right, find each person's blood type.

Joseph: *AB+*
Ryan: *O+*
Beatrice: *B–*
Emily: *AB–*

Can give to →	Joseph	Ryan	Beatrice	Emily
Joseph	yes	no	no	no
Ryan	yes	yes	no	no
Beatrice	yes	no	yes	yes
Emily	yes	no	no	yes

ANSWER KEY — APPLICATION A2 1/2

Chapter 3 • The Material World
Section 2 • Properties of Matter, pp. 234–237
Toolbox • Tool 9, p. 503

Calculating Density

1. What is the density of a liquid if 16 g of the substance has a volume of 2 mL?

Formula	Data	Calculation
$\rho = \frac{m}{V}$	$m = 16\ g$ $V = 2\ mL$	$\rho = \frac{16\ g}{2\ mL}$

Answer: *8 g/mL*

2. A metal block has a volume of 2.5 cm^3 and weighs 75.5 g. What is its density?

Formula	Data	Calculation
$\rho = \frac{m}{V}$	$m = 75.5\ g$ $V = 2.5\ cm^3$	$\rho = \frac{7.5\ g}{2.5\ cm^3}$

Answer: *30.2 g/cm^3*

3. Using the information in the following table, give the density of each metal block and identify the pure substance from which it is made. Refer to Table 3 on page 235 of the student textbook.

	Mass (g)	Volume (cm^3)	Density (g/cm^3)	Pure substance
Metal block A	143.6	12.6	*11.4*	*Lead*
Metal block B	54.3	20.1	*2.7*	*Aluminum*

4. What is the mass of a litre of mercury if it has a density of 13.6 g/mL?

Formula	Data	Calculation
$\rho = \frac{m}{V}$	$\rho = 13.6\ g/mL$ $V = 1000\ mL$	$13.6\ g/mL = \frac{X}{1000\ mL}$ $X = 13.6\ g/mL \times 1000\ mL$

Answer: *13 600 g (13.6 kg)*