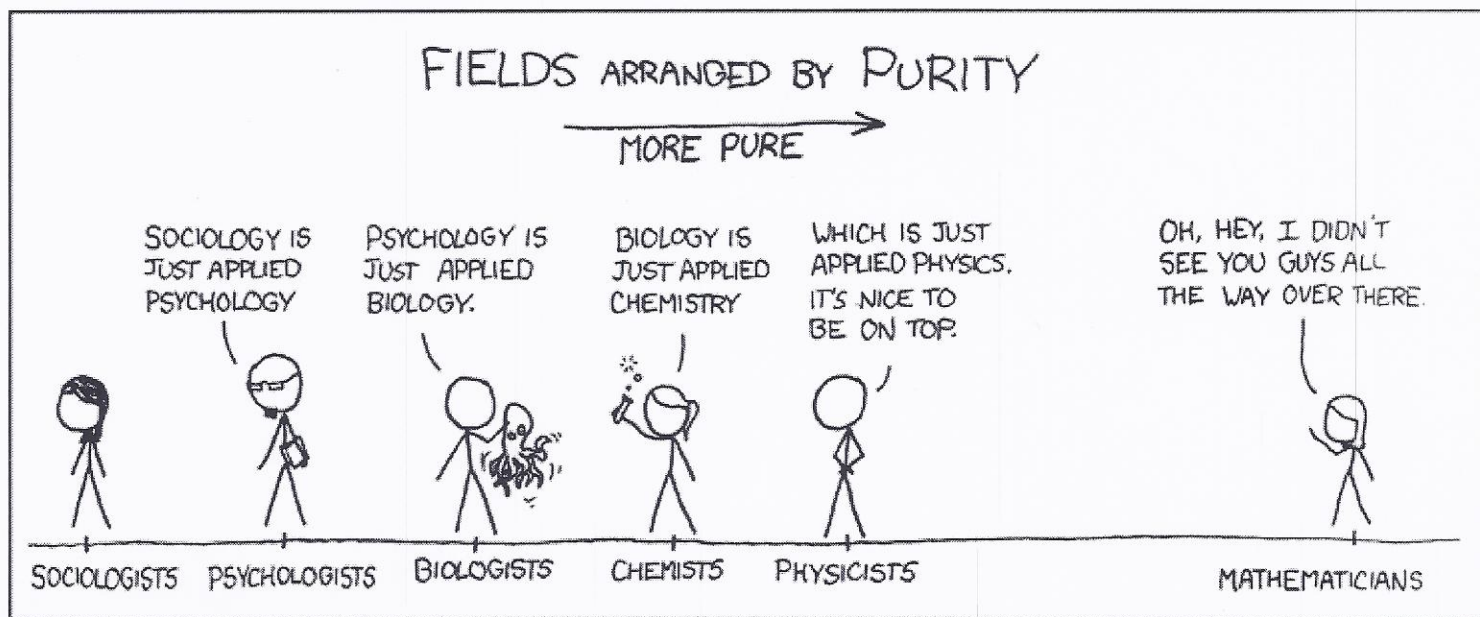


Name _____

Unit Conversions and Dimensional Analysis



Rubric for LS 6

Learning Standards	Performance Indicators
LS 6: Students will be able to quantify a chemical reaction using dimensional analysis and the concept of a mole.	6.1 Convert units using dimensional analysis 6.2 Analyze the chemical composition of a substance using the concept of a mole. 6.3 Quantify a chemical reaction using stoichiometry.

6.1 Convert units using dimensional analysis

4.0	3.0	2.0	1.0	0
Student is able to do all of "3.0" and:	Student is able to:	Student is inconsistently able to:	Student is unable to:	Student shows no evidence of being able to:
Convert units using dimensional analysis for complex unit conversions.	Convert units using dimensional analysis for simple unit conversions.			

LS 6.1 : Problem Solving in Chemistry

Dimensional Analysis

- Used in _____ problems.

**Example:* How many seconds are there in 3 weeks?

- A method of keeping track of the _____.

Conversion Factor

- A _____ of units that are _____ to one another.

**Examples:* 1 min/ _____ sec (or _____ sec/ 1 min)

_____ days/ 1 week (or 1 week/ _____ days)

1000 m/ _____ km (or _____ km/ 1000 m)

- Sometimes the conversion factors are provided to you, and other times, the conversion factors are determined by reading the information given in the problem. (See practice problems for examples.)

How to Use Dimensional Analysis to Solve Conversion Problems

- Step 1: Identify the “_____”. This is typically the only number given in the problem. This is your starting point. Write it down! Then write “x _____”. This will be the first conversion factor ratio.

- Step 2: Identify the “_____”. This is what are you trying to figure out.

- Step 3: Identify the _____.

- Step 4: By using these conversion factors, plan a solution to convert from the given to the unknown.

- Step 5: When your conversion factors are set up, _____ all the numbers on top of your ratios, and _____ by all the numbers on bottom.

If the units did not _____ correctly, you've messed up!

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Practice Problems:

- (1) How many hours are there in 3.25 days?

- (2) How many yards are there in 504 inches?

- (3) Convert 55 miles per hour into miles per minute?

Converting Complex Units

- A complex unit is a measurement with a unit in the _____ and _____.
**Example: 55 miles/hour 17 meters/sec 18 g/mL*
- To convert complex units, simply follow the same procedure as before by converting the units on _____ first. Then convert the units on _____ next.

Practice Problems: (1) The speed of sound is about 330 meters/sec. What is the speed of sound in units of miles/hour? (1609 m = 1 mile)

(2) The density of water is 1.0 g/mL. What is the density of water in units of lbs/gallon? (2.2 lbs = 1 kg) (3.78 L = 1 gal)

(3) Convert 33,500 in² to m² (5280 ft = 1609 m) (12 inches = 1 foot)

- Find the conversion factors in each of the following word problem.

(1) If we want to buy a single head of cabbage that weighs 12 ounces. How many dollars will the head of cabbage cost if the price is 5 cents per pound? (16 ounces = 1 pound)

(2) Jane is buying pizza for class. Each person will get 2 pieces of pizza. There are 30 kids in the class. Each pizza costs \$5 and the pizza will be cut into 8 slices. How many pizzas will Jane need to buy?

Name: _____

Nonsense Conversion Problems

1) Conversion Factors: 3 apples = 5 bananas 6 cookies = 7 apples 2 doughnuts = 1 banana

How many doughnuts are equal to 20 cookies?

2) Conversion Factors: 1 elephant = 13 farmers 23 gorillas = 4 horses 5 farmers = 2 horses

How many elephants are equal to 10 gorillas?

3) Conversion Factors:

3 Icelanders = 4 Jamacians 2 Lithuanians = 3 Moroccans 1 Korean = 3 Jamaicans 3 Koreans = 5 Lithuanians

How many Moroccans are equal to 1 Icelander?

4) Conversion Factors: 2 Nighthawks = 5 Orioles 1 Oriole = 15 Parrots 4 Quail = 3 Parrots

How many nighthawks are equal to 3 quail?

5) Conversion Factors:

3 Rams = 8 Vikings 4 Titans = 5 Chargers 7 Titans = 3 Seahawks 9 Vikings = 1 Charger

How many Seahawks are equal to 2 Rams?

Name: _____

Worksheet #1: Conversion Problems

1) 3 holits = 5 gorfs 7 gorfs = 2 queets

How many queets are there in 43 holits?

2) 5 pliggles = 7 cammies 1 cammie = 3 kacks 15 kacks = 9 ploofs

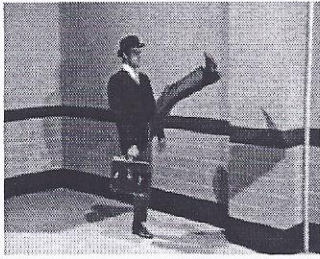
How many ploofs are there in 22 pliggles?

3) 2 borks = 1 grog 4 deebbs = 3 loggits 8 grogs = 1 poff 3 poffs = 10 deebbs

How many loggits are there in 44 borks?

4) How many seconds are there in one millennium? (1,000 years = 1 millennium)

5) How fast is 250 miles/hour in units of kilometers/second? (1.609 km = 1 mile)



Name _____

The English system is silly!

1) Volume (Going from a small volume to a big volume)

Convert 10,000 mL to kL

Convert 10,000 teaspoons to gallons

2) Length (Going from a small length to a big length)

Covert 10,000 mm to km

Covert 10,000 in to miles

3) Mass (Going from a small mass to a big mass)

Convert 10,000 mg to kg

Convert 10,000 oz to lbs

Name: _____

1 and 2 Step Conversion Problems

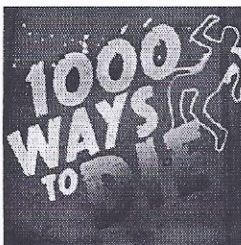
Convert the following "one step" conversion problems:

- 1) How many grams of helium are there in 2.7 moles of helium? (4.0 grams of He = 1 mole of He)
- 2) How many mm of mercury are there in 25.0 in. of mercury? (29.92 in. of Hg = 760 mm of Hg)
- 3) How many liters of oxygen are there in 4.5 moles of oxygen? (1 mole of O₂ = 22.4 Liters of O₂)
- 4) How many grams of neon are there in 75.0 liters of neon? (20.2 grams of Ne = 22.4 Liters of Ne)
- 5) How many mi/hr are there in 36.9 mi/day? (24 hours = 1 day)

Convert the following "two step" conversion problems:

- 6) How many miles are there in 4.3 light-years? (9.46 x 10¹⁵ m = 1 light-year) (1609 m = 1 mile)
- 7) How many weeks are in 9,500 hours? (1 week = 7 days) (24 hours = 1 day)
- 8) How many miles/hour are there in 186,000 miles/second? (60 sec. = 1 min.) (1 hr = 60 min.)
- 9) How many miles/hour is 340 meters/sec? (3,600 sec = 1 hour) (1609 m = 1 mile)
- 10) How many liters of hydrogen can be made from decomposing 13.0 moles of ammonia?
(2 moles of ammonia = 3 moles of hydrogen) (1 mole of hydrogen = 22.4 liters of hydrogen)

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Name _____

Conversions and Toxicity

Instructions: Use conversion factors to convert the following. Circle the correct answer.

Information found from MSDS LD50 on rats.

Your Weight: _____ lbs

- 1) Convert your weight into kilograms: (1kg = 2.2lbs)

Your Weight: _____ kg

- 2) Knowing that water's toxicity is 90 mL water per 1 kg body weight how many mL of water will kill you if you drink it?

Using your answer from above, drinking how many gallons of water will kill you?
(1000 ml in 1 L, 1 gallon is 3.78 L)

- 3) Knowing that caffeine's toxicity is 150 mg caffeine to 1 kg body mass how much caffeine will kill you?

How many cups of coffee will kill you if there is 100 mg caffeine per cup of coffee?

- 4) Don't tell your parents I told you this one. Oranges contain Vitamin C (ascorbic acid) which is necessary for our survival. If the toxicity of vitamin C is 3,367 mg per 1 kg of body weight and there is 70 mg of vitamin C in an orange, how many oranges could you eat before you died?
- 5) Cyanide is a commonly known family of poisons. Hydrogen cyanide (HCN) is the most deadly with a toxicity of 3.7×10^{-3} g/ 1 kg of body mass. How much hydrogen cyanide would kill you?
- 6) Thallium is the most poisonous element. How much thallium would kill you if the toxicity is 0.00045 g/ 1 kg of body mass?
- 7) The deadliest neurotoxin comes from the bacteria called Botulism. Botulinum harvested from this disease is also commonly called Botox. If the toxicity of Botulinum is 1.60×10^{-7} g/ 1 kg, how much would kill you?

Name: _____

Worksheet #2: More Conversion Problems

- 1) The speed of light is 3.0×10^8 m/sec. How fast is this in miles/hour? (1609 m = 1 mile)

- 2) How many hours of class does a student attend in H.S.? (Here re your assumptions: Assume perfect attendance; 4 years to graduate; 50 minute classes; 7 classes per day; each year of H.S. is 180 days of class; ignore the fact that there are late start days, half days, exam days, etc.)

- 3) A person drives a car that gets 30 miles per gallon of gasoline. Each gallon of gas cost \$3.15 and the car is driven 320 miles. How much money is needed for gasoline?

- 4) Fifteen people are going to a cookout. If each person eats 2 hot dogs and there are 8 hot dogs in each package.
 - a. How many packages will need to be purchased for the cookout?

 - b. If each package costs \$1.89, how much money will it cost to buy the hot dogs?

- 5) Convert 72.6 cm into m . (1 m = 100 cm)

- 6) Convert 583 mm into in . (2.54 cm = 1 in.) (10 mm = 1 cm)

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Fun Conversion Problems!

Make sure you label your answer and put units!

- 1) How many doughnuts stacked end to end (like "OOOO") will it take to reach the moon? Assume that each doughnut has a diameter of 0.04m and the distance from Central High School to the moon is 384,403 m.

A dozen day old doughnuts cost \$1.25 at Meijer. How much would it cost to make our doughnuts reach the moon?

- 2) How many Jell-O pudding packages would you need to fill an Olympic size swimming pool? The dimensions of the pool are 50m x 25m x 2m and each pudding package makes 112 mL of pudding. (Hint: convert m^3 to cm^3 and remember that 1 cm^3 is the same as a mL!)
- 3) How many days would it take to watch every Family Guy episodes to date? As of January 9, 2013 there are 194 episodes. Assume that each Family Guy episode is 23 minutes.
- 4) If everyone in the world stood on each other's head, would we be able to touch the sun? The moon? Assume that the average height of humans on earth is 169.25 cm and that there are 7,021,836,029 people on earth (as of writing this paper). The distance to the sun is 1 AU or 1.49×10^8 km and the distance to the moon is written in problem 1.

Name: _____

Chemistry Conversions Quiz Review

Here are the conversion factors you need plus a few extra just for fun!

365 days = 1 year	7 days = 1 week	24 hours = 1 day	60 seconds = 1 minute
60 minutes = 1 hour	16 tablespoons = 1 cup	3 teaspoons = 1 tablespoons	
4 quarts = 1 gallon	5280 feet = 1 mile	12 inches = 1 foot	3 feet = 1 yard
0.625 miles = 1 km	1000 m = 1 km		

Show your work! Make sure you use units and label your final answer!

1) How many seconds are there in 1.25 days?

2) It is Muffin Friday! Mr. T is making his famous bacon muffins. However, he can only find a teaspoon! How many teaspoons does Mr. T have to measure out to be equivalent to 12 cups of flour?

3) How much money will it cost to provide cake for 52 students if each student eats 3 pieces of cake, each cake has 16 pieces, and each cake costs \$4.75?

4) NASA has sent many instruments to explore the planet Mars. In order to safely land on the planet's surface a Mars Rover must be going under 23,455 feet/ second before the parachute is deployed. However, since NASA uses the metric system you need to convert the speed to km/hour or the Rover will crash!

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Name: _____

Chapter 4-Chemistry Conversions Test Review

Show your work! Make sure you use units and label your final answer!

- 1) How many inches are in 3.9 miles? (12 inches = 1 foot, 1 yards= 3 feet, 5,260 feet = 1 mile)

- 2) Mr. T has been dating his girlfriend for one year, nine months, and six days. How many hours has Mr. T been in a relationship? (Assume Mr. T put "in a relationship" on Facebook the second they started dating)

- 3) On October 15, 1997 Andy Green set the land speed record with the ThrustSSC getting up to 1223.657 km/hour. What is this speed in miles/hour? (1km =0.625 miles)

- 4) A student drinks 3 cans of Mt. Dew per day. What is this student's rate of consumption in terms of cases/year? Hint: Start off with 3cans/day.
(12 cans = 1 case) (365days = 1 year)