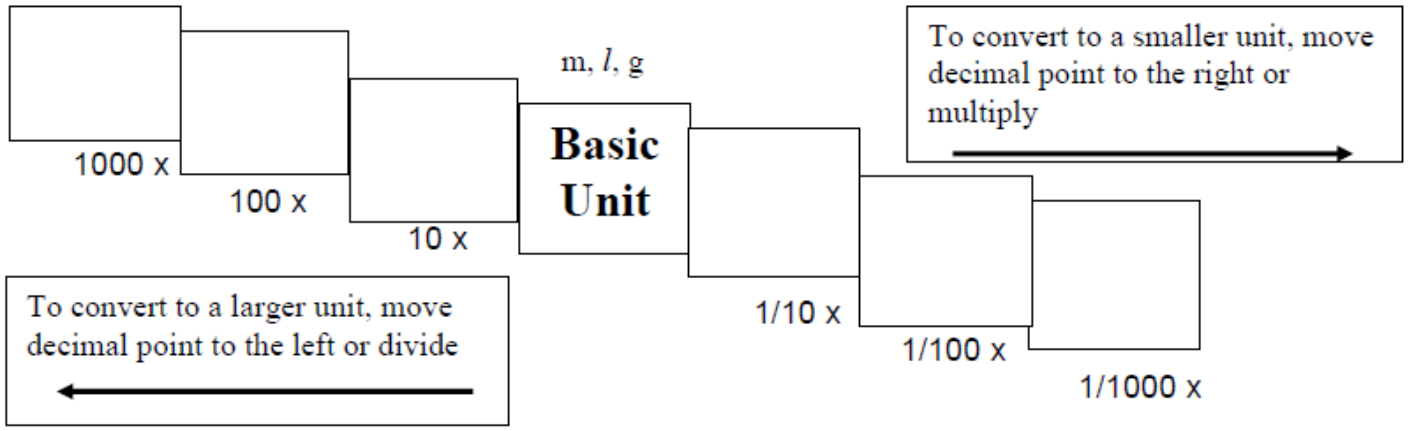
Dougherty Valley HS Chemistry
Metric Mania Metric Conversion Practice

Worksheet #2

Name: **Period:** **Seat#:**



Try these conversions using the ladder method:

1) 1000mg = _____ g	**2)** 1L = _____ mL	**3)** 160cm = _____ mm
4) 14 km = _____ m	**5)** 109g = _____ kg	**6)** 250m = _____ km

Compare using <, >, or =:

7) 56cm ◯ 6m

8) 7g ◯ 698mg

Write the correct abbreviation for each metric unit.

9) Kilogram _____ **10)** Milliliter _____ **11)** Kilometer _____

12) Meter _____ **13)** Millimeter _____ **14)** Centimeter _____

15) Gram _____ **16)** Liter _____ **17)** Milligram _____

Dougherty Valley HS Chemistry
Metric Mania Metric Conversion Practice

Try these conversions, using the ladder method

18) 2000 mg = _____ g

19) 104 km = _____ m

20) 480 cm = _____ m

21) 5.6 kg = _____ g

22) 8 mm = _____ cm

23) 5 L = _____ mL

24) 198 g = _____ kg

25) 75 mL = _____ L

26) 50 cm = _____ m

27) 5.6 m = _____ cm

28) 16 cm = _____ mm

29) 2500 m = _____ km

30) 65 g = _____ mg

31) 6.3 cm = _____ mm

32) 120 mg = _____ g

Compare using <, >, or =:

33) 63 cm ◯ 6 m

34) 5 g ◯ 508 mg

35) 1,500 mL ◯ 1.5 L

36) 536 cm ◯ 53.6 dm

37) 43 mg ◯ 5 g

38) 3.6 m ◯ 36 cm

Dougherty Valley HS Chemistry
Dimensional Analysis Practice 1

Worksheet #3

Name: **Period:** **Seat#:**

These are practice problems. It is assumed that you have already been introduced to the method of "dimensional analysis." Answers are provided at the end of each problem. They are underlined. You should look at the question, work it out on paper (not in your head) before checking the answers at the end. The purpose of these problems is not merely to get the right answer, but to practice writing out the dimensional analysis setup. We will be using this method all semester and I will be asking for your setups, so don't just work out an answer on your calculator without writing out a setup.

In these practice problems, I am going to ask you to stick to ONLY the following conversions between the English and metric system (these are the only conversions that I will give you on exams). In some cases you can look up conversions elsewhere, but I would rather you didn't. I want you to learn how to make conversions that take more than one single step.

1 inch = 2.54 cm exactly	**1 lb = 454 g**	**1 qt = 0.946 L**	**1 g = 1 x 10^9 ng**
1 mi = 5280 ft	**1 qt = 2 pt**	**4qt = 1 gal**	

You should also remember that 1 cc = 1 cm^3 = 1 mL exactly. (This is a conversion you need to know.)
For all problems, show your dimensional analysis setup. Remember you can use the conversions shown above. Even if it is a metric conversion please practice with Dimensional Analysis, don't use "King Henry."

1) Convert 3598 grams into pounds. *7.93*

2) Convert 231 grams into ounces. *8.14*

3) A beaker contains 578 mL of water. What is the volume in quarts? *0.611*

4) How many ng are there in 5.27×10^{-13} kg? *0.527*

Dougherty Valley HS Chemistry
Dimensional Analysis Practice 1

5) What is 7.86×10^{-2} kL in dL? *786*

6) What is 0.0032 gallons in cL? *1.2*

7) A box measures 3.12 ft in length, 0.0455 yd in width and 7.87 inches in height. What is its volume in cubic centimeters? *7910*

If a unit is squared, cubed, etc. then your conversion factors will need to also be squared, cubed etc.

1 in = 2.54 cm but $1\ in^2 = (2.54\ cm)^2$ $= 6.4516\ cm^2$

1 ft = 12 in but $1\ ft^3 = (12\ in)^3$ $= 1728\ in^3$

8) A block occupies $0.2587\ ft^3$. What is its volume in mm^3? *7.326×10^6*

9) If you are going 55 mph, what is your speed in nm per second? *2.5×10^{10}*

10) If the density of an object is 2.87×10^{-4} lbs/cubic inch, what is its density in g/mL? *7.95×10^{-3}*

Dougherty Valley HS Chemistry
Dimensional Analysis Practice 2

Worksheet #4

Name: **Period:** **Seat#:**

Instructions: Show your work. Put a box around your final answer so that it can be found easily. You must use Dimensional Analysis to solve. Some answers are provided at the end of the questions. They are underlined.

1) Jules Verne wrote a book called Twenty Thousand Leagues Under the Sea. Using the conversion factors given, convert 20,000 leagues into inches: *4.38×10^9*

12 in = 1 ft	3 ft = 1 yd	1 fathom = 2 yds
1 statute mile = 5280 ft	1 nautical mile = 6080 ft	1 league = 3 nautical miles

2) Convert 73 mi/hr into in/min. *77088*

3) Some owls maintain a territory of up to 3 acres. How many owls could live in a large wooded area of 20 hectacres? *16*

1 hectare = 1 square decameter = 100 square meters = 2.47 acres

4) One 1.6 oz. Package of cinnamon and spice instant oatmeal contains 34 g of carbohydrates. If you had instant oatmeal 6 days a week, how many ounces of carbohydrates would you consume in one week?
16 oz = 1 lb = 454 g = 256 Drams = 7000 grains *7.19*

Dougherty Valley HS Chemistry
Dimensional Analysis Practice 2

5) Many candy gazelle's have 9 grams of fat per bar. If during a "chocolate attack" you ate one 6-pack of bars (0.6 Decabars), how many ounces of fat would you have eaten? If there are approximately 9 calories per gram of fat, how many Calories is this? *1.90, 486*

6) You are riding home from a party and the driver has been drinking. The car is traveling 60 mi/hr. Suddenly a child steps out into the road ahead. Because the driver has been drinking, his reaction time has been slowed by one second. How many feet toward the impeding accident will the car travel before the drive begins to stop? (This is equal to the extra distance it will take to stop the car because the driver has been drinking) *88*

7) In an old episode of the TV program McGyver; a planeload of gold was being transported from the Soviet Union to the United States during WWII. The place crashed in the Arctic region. To prevent the "bad guys" from getting the gold, the pilot and copilot transferred the gold into a cave by stacking it on a door of the crashed plane and dragging the "sled" into the cave. You were led to believe in the episode that they accomplished the move in one trip. The gold was stacked neatly in the shape of a cube, measuring about 1 meter on a side. Calculate the weight, in tons, of one cubic meter of gold. The density of gold is 19.4 g/cc. Would it have been possible for the two pilots to accomplish this feat? Would a plane of WWII vintage be able to carry this much gold? (cc = cubic centimeter, $1cm^3 = 1mL$) *21.4, nope!*

Dougherty Valley HS Chemistry
Significant Figures Practice 1

Worksheet #5

Name: **Period:** **Seat#:**

Give the number of significant figures in each of the following:

1) 402 m	**2)** 34.20 lbs	**3)** 0.03 sec	**4)** 0.00420 g
5) 3200 liters	**6)** 0.0300 ft.	**7)** 5.1×10^4 kg	**8)** 0.48 m
9) 1400.0 m	**10)** 78323.01 g	**11)** 1.10 torr	**12)** 760 mm Hg

Multiply each of the following, observing significant figure rules:

13) 17 m x 324 m =	**14)** 1.7 mm x 4294 mm =
15) 0.005 in x 8888 in =	**16)** 0.050 m x 102 m =
17) 0.424 in x .090 in =	**18)** 324000 cm x 12.00 cm =

Divide each of the following, observing significant figure rules:

19) 23.4 m ÷ 0.50 sec =	**20)** 12 miles ÷ 3.20 hours =
21) 0.960 g ÷ 1.51 moles =	**22)** 1200 m ÷ 12.12 sec =

Add or subtract each of the following, observing significant figure rules:

23) 3.40 m + 0.022 m + 0.5 m	**24)** 102.45 g + 2.44 g + 1.9999 g	**25)** 102. cm + 3.14 cm + 5.9 cm
26) 42.306 m - 1.22 m	**27)** 14.33 g - 3.468 g	**28)** 234.1 cm – 62.04 cm

Dougherty Valley HS Chemistry
Significant Figures Practice 1

Work each of the following problems, observing significant figure rules:

29) Three determinations were made of the percentage of oxygen in mercuric oxide. The results were 7.40%, 7.43%, and 7.35%. What was the average percentage?

30) A rectangular solid measures 13.4 cm x 11.0 cm x 2.2 cm. Calculate the volume of the solid.

31) If the density of mercury is 13.6 g/ml, what is the mass in grams of 3426 ml of the liquid?

32) A copper cylinder is 12.0 cm in radius and has a height of 44.0 cm. If the density of copper is 8.90 g/cm^3, calculate the mass in grams of the cylinder. Remember that the equation for volume is $v = \pi r^2 h$ (assume pi = 3.14)

Dougherty Valley HS Chemistry
Significant Figure Practice 2

Worksheet #6

Name: **Period:** **Seat#:**

State the number of significant digits in each measurement.

1) 2804 m	**2)** 2.84 km	**3)** 5.029 m	**4)** 0.003068 m
5) 4.6×10^5 m	**6)** 4.06×10^{-5} m	**7)** 75,000 m	**8)** 750 m
9) 75 m	**10)** 75.00 m	**11)** 75,000.0 m	**12)** 10 cm

Round the following numbers as indicated:

To four figures:

13) 3.682417	**14)** 21.860051	**15)** 375.6523	**16)** 112.511	**17)** 45.4673

To one decimal place:

18) 1.3511	**19)** 2.473	**20)** 5.687524	**21)** 7.555	**22)** 8.235

To two decimal places:

23) 22.494	**24)** 79.2588	**25)** 0.03062	**26)** 3.4125	**27)** 41.86632

Solve the following problems and report answers with appropriate number of significant digits.

28) 6.201 cm + 7.4 cm + 0.68 cm +12.0 cm =	**29)** 1.6 km + 1.62 m +1200 cm =
30) 8.264 g - 7.8 g =	**31)** 10.4168 m - 6.0 m =
32) 1.31 cm x 2.3 cm =	**33)** 5.7621 m x 6.201 m =
34) 20.2 cm / 7.41 s =	**35)** 12.00 kg + 15.001 kg =

Dougherty Valley HS Chemistry
Significant Figure Practice 2

Express the following numbers in scientific notational form:

36) 123,876.3	**37)** 1,236,840	**38)** 422000
39) 0.000000000000211	**40)** 0.000238	**41)** 0.0000205

Solve the sums or differences of the following with correct sig figs:

42) $(8.41 \times 10^4) + (9.71 \times 10^4) =$	**43)** $(5.11 \times 10^2) - (4.2 \times 10^2) =$
44) $(8.2 \times 10^3) + (4.0 \times 10^3) =$	**45)** $(6.3 \times 10^{-2}) - (2.1 \times 10^{-2}) =$

Solve the product and the quotients of the following with correct sig figs:

46) $(3.56 \times 10^5)\ (4.21 \times 10^6) =$	**47)** $(2 \times 10^7)\ (8 \times 10^{-9}) =$
48) $(4.11 \times 10^{-6})\ (7.51 \times 10^{-4}) =$	**49)** $8.45 \times 10^7 / 6.74 \times 10^3 =$
50) $9.7 \times 10^8 / 8.6 \times 10^{-2} =$	**51)** $4.7 \times 10^{-2} / 5.7 \times 10^{-6} =$

Dougherty Valley HS Chemistry
Extra Practice

Worksheet #7*

Name: **Period:** **Seat#:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

Perform the following conversions.

1) 70 cm to m	**2)** 49 cm to mm	**3)** 8 m to mm	**4)** 14.76 m to cm	**5)** 8500 cm to m	**6)** 20 mm to m
7) 6 L to cl	**8)** 4.1 L to ml	**9)** 8.7 L to ml	**10)** 12.5 cl to L	**11)** 925 mg to Kg	**12)** 412. 6 Kg to g
13) 8 cm x 7 cm x 6 m = ? cm^3		**14)** 4 cm x 9 cm x 12 cm = ? mL		**15)** 15 m x 12 cm x 5 cm = ? mL	

Convert: using Dimensional Analysis method (show your work in Dimensional Analysis format)

16) 8000 g to Kg	**17)** 25,000 g to Kg	**18)** 2 mm to Km	**19)** 12.42 Kg to g	**20)** 4.2 g to mg
21) One nickel weighs 5 grams. How many nickels are in 1 Kg of nickels?				

What is the mass of each item in kg, mg, and g? (You will do multiple conversions for each question)

22) Potatoes 5Kg	**23)** Flour 11Kg	**24)** Turkey 8000g	**25)** Cereal 250g	**26)** Candy 340g	**27)** Medicine 550 mg

Answer the following questions:

28) What is the fundamental unit used to measure mass?	**29)** What does the prefix "centi" mean?	**30)** What does the prefix "kilo" mean?

Perform the following dimensional analysis conversions of "double units"

31) 37 in/sec to miles/year	**32)** 25m/hr to km/day	**33)** 1.75×10^{13}mm/min to ft/hour

SIGNIFICANT DIGIT REVIEW

Significant figures are the digits in any measurement that are known with certainty plus one digit that is uncertain.

Rule 1: All non-zero digits are significant 3.1425 [5] 3.14 [3] 469 [3]	**Rule 2**: All zeros between significant digits are significant 7.503 [4] 7053 [4] 302 [3]	**Rule 3**: In a number with digits to the right of a decimal place, zeros to the right of the last non-zero digit are significant 43 [2] 0.00200 [3] 43.0 [3] 0.40050 [5] 43.00 [4]	**Rule 4**: Zeros to the left of the first non-zero digit that act, as placeholders are NOT significant. 0.0056 [2] 0.0789 [3] 0.000001 [1]
Rule 5: In a number that has no decimal point, and that ends in zeros (such as 3600), the zeros at the end may or may not be significant (it is ambiguous). To avoid ambiguity express the number in scientific notation showing in the coefficient the number of significant digits. Example: 3.6×10^3 contains two significant digits			

How many significant digits are in each of the following numbers?

34) 1837	**35)** 205.8	**36)** 3.14145E4	**37)** 1900.5	**38)** 6005	**39)** 1200.43
40) 0.08206	**41)** 6000.00	**42)** 0.000014	**43)** 632.0000	**44)** 149356.1	**45)** 14.163000
46) 8.7300	**47)** 14	**48)** 0.00743	**49)** 302400.00	**50)** 302400	**51)** 0.0019872
52) 8.732	**53)** 20000	**54)** 14.000	**55)** 426.1	**56)** 19.7342	**57)** 60

Convert the following number into or out of scientific notation:

58) 142.63	**59)** 1,500,000.00	**60)** 0.00336	**61)** 1.63E7	**62)** 3.11E-4	**63)** 0.00125
64) 86,400.00	**65)** 1.01E6	**66)** 9.81E1	**67)** 0.000000000000144	**68)** 4,633,310.56	

Dougherty Valley HS Chemistry
Extra Practice

Round each of the following numbers to four significant digits:

ROUNDING **GENERAL RULES FOR ROUNDING:** XY → X When Y ≥ 5, increase X by 1 When Y < 5, don't change X	**69)** 6.19648	**70)** 0.0019872	**71)** 3.14145E4
	72) 213.25	**73)** 14.163000	**74)** 90210
	75) 234.4	**76)** 1200.43	**77)** 0.0022475
	78) 14.16300	**79)** 0.02315	**80)** 13.462
	81) 135.69	**82)** 152.00	**83)** 395.55

Add or subtract as indicated and state the answer with the correct number of significant digits

84) 85.26 cm + 4.6 cm	**85)** 1.07 m + 0.607 m	**86)** 186.4 g - 57.83 g
87) 60.08 s - 12.2 s	**88)** 4,285.75 - 520.1 - 386.255	**89)** 72.60 m + 0.0950 m

Multiply or divide as indicated and state that answer with the correct number of significant digits

90) (5.5 m) (4.22 m)	**91)** (0.0167 km) (8.525 km)	**92)** 2.6 kg / 9.42 m^3
93) 0.632 m /3.8 s	**94)** (8.95)(9.162) **/** (4.25)(6.3)	**95)** 0.0045 mm^2 / 0.90 mm

Evaluate the following with answers expressed to proper number of significant digits.

96) 4.22E5 + 3.11E7 + 6.003E6	**97)** (9.11E-28)(6.02E23)	**98)** 2.160E3 + 6.2000E4 + 5.2E1	**99)** (8.4E7)/(2.1E4)
100) (8.4E-7)/(2.1E4)	**101)** (8.4E7)/(2.1E-4)	**102)** (8.4E-7)/(2.1E-4)	**103)** (6.02E23)/(9.11E28)

Given the following numbers (a-e), solve the following problems, expressing the answer to the proper number of significant digits.

(a) 1.72 cm
(b) 0.15 cm
(c) 627.1 cm
(d) 0.007 cm
(e) 704.050 cm

104) a + b + c + d + e	**105)** a + c + e	**106)** c - a	**107)** e - b
108) (a + c) - (b + d)	**109)** (a) (e)	**110)** (c) (d)	**111)** (a + b) (b + e)
112) c / b	**113)** e / d	**114)** (b + c) / (e - c)	**115)** $(b)^3$

Dougherty Valley HS Chemistry
Changes, Properties, and Types of Matter

Worksheet #8

Name: **Period:** **Seat#:**

Fill in the following definitions

	Vocab Word	Definition
1)	Physical Property	
2)	Physical Change	*Change in which the identity of the substance does NOT change*
3)	Chemical Property	
4)	Chemical Change	

Identify each as either a chemical or a physical PROPERTY. Use C for chemical, P for physical.

Statement	C or P	Statement	C or P
5) Blue color		**6)** Density	
7) Flammability		**8)** Solubility	
9) Supports combustion		**10)** Sour taste	
11) Melting point		**12)** Odor	
13) Luster		**14)** Neutralize an acid	
15) Boiling point		**16)** Hardness	
17) Reacts with acid to form H_2		**18)** Reacts with water to form a gas	

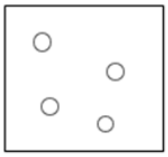
Identify each as either a chemical change or a physical CHANGE. Use C for chemical, P for physical.

Statement	C or P	Statement	C or P
19) Glass breaking		**20)** Hammering wood together	
21) A rusting bicycle		**22)** Melting butter	
23) Separating sand from gravel		**24)** Bleaching your hair	
25) Frying an egg		**26)** Squeeze oranges for juice	
27) Melting ice		**28)** Mixing salt and water	
29) Mixing oil and water		**30)** Water evaporating	
31) Cutting grass		**32)** Burning leaves	
33) Fireworks exploding		**34)** Cutting your hair	
35) Crushing a can		**36)** Boiling water	
37) Combustion		**38)** Melting	
39) Dissolving		**40)** Metabolizing	
41) Filtering		**42)** Fermenting	
43) Decomposing		**44)** Distilling	
45) A pellet of sodium is sliced into two pieces		**46)** HCl reacts with NaOH to produce a salt, water, and heat	
47) Potassium chlorate decomposes to potassium chloride and oxygen gas		**48)** Acid on lime stone produces carbon dioxide gas	
49) Ice melts		**50)** Iron rusts	
51) Crack an egg		**52)** Bake a cake	

Dougherty Valley HS Chemistry
Changes, Properties, and Types of Matter

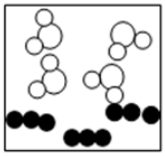
Directions: Identify each lettered box with as many of the following terms that makes sense: atom, molecule, compound, solid, liquid, gas, pure substance, mixture, homogeneous mixture, heterogeneous mixture. Highlight the words that apply.

A



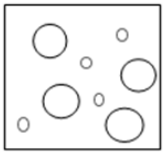
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

B



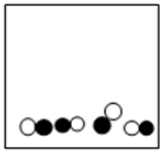
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

C



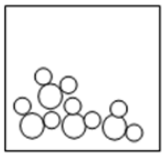
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

D



Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

E



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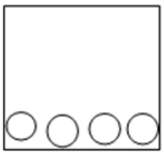
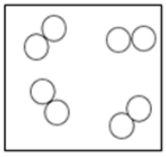
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

F



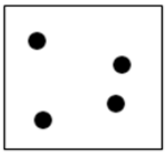
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

G



Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

H



Atom *Solid* *Pure Substance*
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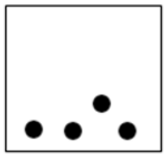
Compound *Gas* *Homogeneous*
Heterogeneous

I



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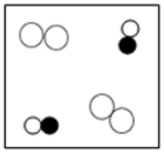
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

J



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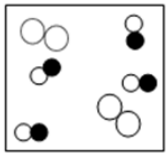
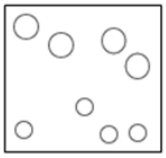
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

K



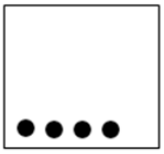
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

L



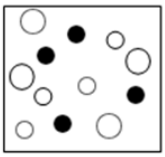
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

M



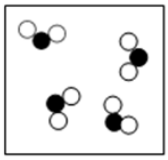
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

N



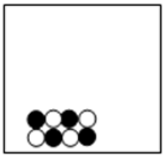
Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

O



Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

P



Atom *Solid* *Pure Substance*
Molecule *Liquid* *Mixture*
Compound *Gas* *Homogeneous*
Heterogeneous

Dougherty Valley HS Chemistry
Atomic Web Quest

Worksheet #9

Name: **Period:** **Seat#:**

Section 1: Dalton's Theories

- **Site:**https://drive.google.com/file/d/1VBYfxYSn2KZ9Yi_yfT8BDuaVj_FKc491/view?usp=sharing
- **Site:**https://drive.google.com/file/d/1VAylmVN_M1edTrRmbvGG7AUP3aFJnfQt/view?usp=sharing

1) Summarize (in your own words) the five parts to Dalton's Atomic Theory.

2) What are two problems with Dalton's Atomic Theory that we know with todays knowledge?

Section 2: First Subatomic Particle of the Atom

- **Site:**https://drive.google.com/file/d/1V48kxBnzey-ExwajSQQ2qd4DymFb94qf/view?usp=sharing
- **Site:** https://drive.google.com/file/d/1UtzkBmJBVFP_8EOW_sCFPanhcK5vyRv/view?usp=sharing (scroll way down to look for Thomson)

3) "Atoms are small, indivisible particles. There is nothing smaller than an atom." Why would Thomson disagree with this statement?

4) What subatomic particle did Thomson discover and what was its charge?

5) Describe how Thomson found the subatomic particle?

6) If the positive side of a magnet was placed near the cathode ray would the ray bend towards or away from the magnet? Explain.

7) What is the name of the main piece of equipment used by Thomson? After doing some internet search what is it used for today?

Dougherty Valley HS Chemistry
Atomic Web Quest

Section 3: Finding the Mass of the Atom

- **Site:** https://drive.google.com/file/d/1Ut8r5N0ICkvZKnSjzwmiMNH8g8kV-qIK/view?usp=sharing

8) What was the name of Rutherford's most famous experiment?

9) Describe and/or illustrate what Rutherford's experiments looked like.

10) What did Rutherford conclude was in the middle of the atom?

11) Use what you know about matter to explain why Rutherford concluded that it was a positive charge in the center of the atom.

12) Why did most of the alpha particle go through the gold foil?

13) J.J. Thomson said the atom is filled with "positive sea"with small, negative particles called electrons. Would Rutherford agree or disagree with this statement? Why?

Section 4: Bohr Atom

- **Site: https://drive.google.com/file/d/1Uiz8gmqcqvotXwZzwvi4PdLJeHlZL3zz/view?usp=sharing**
- **Site: https://drive.google.com/file/d/1Ueu8N5L9-oIweh-0vT1ugCLJYJrXL3r3/view?usp=sharing**

14) What happens to an electron's location when it absorbs energy? What happens when it radiates energy? (3rd paragraph)

15) What problems are found with the Bohr model?

16) Draw and label the parts of the atom for a Bohr Model atom

Dougherty Valley HS Chemistry
Atomic Numbers and Isotopes

Worksheet #10

Name: **Period:** **Seat#:**

Complete the following chart and answer the questions below:

Element Name	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons	Mass Number
carbon					12
	8		8		
hydrogen					1
		6			14
hydrogen			2		
nitrogen					14
			1		2
	92		146		
cesium			82		
	11		12		
		47			108
tungsten			110		
			45		80
		24			52
			89		152
silver					107
	76		114		

Answer the following questions in full sentences.

1) How are the atomic number and the number of protons related to each other? Support.

2) How do the number of protons, number of neutrons, and the mass number relate to each other? Explain.

3) What is the one thing that determines the identity of an atom (that is, whether it is an oxygen atom or a carbon atom, etc.)? Support.

Dougherty Valley HS Chemistry
Atomic Numbers and Isotopes 2

Worksheet #11

Name: **Period:** **Seat#:**

Complete the following chart and answer the questions below:

1) The 3 particles of the atom are: _____ _____ _____

2) Their respective charges are: _____ _____ _____

3) The number of protons in one atom of an element determines the atom's _____, and the number of electrons determines the _____ of an element.

4) The atomic number tells you the number of _____ in one atom of an element. It also tells you the number of _____ in a neutral atom of that element. The atomic number gives the "identity" of an element as well as its location on the Periodic Table. No two different elements will have the same _____ number.

5) The _____ of an element is the average mass of an element's naturally occurring atom, or isotopes, taking into account the _____ of each isotope.

6) The _____ of an element is the total number of protons and neutrons in the _____ of the atom.

7) The mass number is used to calculate the number of _____ in one atom of an element. In order to calculate the number of neutrons you must subtract the _____ from the _____.

Give the symbol and number of protons in one atom of:

8) Lithium	**9)** Iron	**10)** Oxygen	**11)** Kyrpton
12) Bromine	**13)** Copper	**14)** Mercury	**15)** Helium

Give the symbol and number of electrons in one atom of:

16) Uranium	**17)** Boron	**18)** Antimony
19) Chlorine	**20)** Iodine	**21)** Xenon

Give the symbol and number of neutrons in one atom of:

22) Barium	**23)** Bismuth	**24)** Carbon	**25)** Mercury
26) Magnesium	**27)** Hydrogen	**28)** Fluorine	**29)** Europium

Dougherty Valley HS Chemistry
Atomic Numbers and Isotopes 2

Name the element which has the following number of particles

30) 26e, 29n, 26p	**31)** 53p, 74n	**32)** 2e (neutral atom)
33) 20p	**34)** 86e, 125n, 82p (charged atom)	**35)** Zero neutrons

How many protons, electrons, and neutrons does each element or ion have (list in that order). Assume the most abundant isotope (use the rounded mass from the periodic table).

36) Ca^{2+}	**37)** F^{-}	**38)** Fe^{3+}
39) O^{2-}	**40)** N^{3-}	**41)** Br^{-}

If you know ONLY the following information, can you always determine what the element is? Yes or No?

42) The number of protons	**43)** The number of neutrons	**44)** The number of electrons in a neutral atom	**45)** The number of electrons

A typical isotopic symbol takes this form:

$${}^{A}_{Z}X$$

Example: Fluorine

$${}^{19}_{9}F$$

Key:
X = element symbol
A = mass number [# of protons (p) + # neutrons (n)]
Z = atomic number [# of protons]
N = # of neutrons
A - Z = N

Fill in the missing items in the table below:

	Name	Symbol	#'s		Isotopic Symbol
46)		Na	Z		
			A		
			# p		
			# e		
			# n		
47)			Z		
			A		
			# p	**75**	
			# e		
			# n		
48)	Potassium		Z		
			A		
			# p		
			# e		
			# n		

Dougherty Valley HS Chemistry
Average Atomic Mass Calculations

Worksheet #12

Name: **Period:** **Seat#:**

AVERAGE ATOMIC MASS READING:
Look at the atomic masses of a few different elements on your periodic table. Do you notice that very few of the elements have atomic masses that are close to being nice whole numbers? Do you know why this is? After all, for our purposes, the mass of both the proton and the neutron are almost exactly 1, and in chemistry we usually ignore the mass of the electron because it is so very small. Why then, if the mass of the atom comes mainly from the protons and neutrons it contains, don't the atomic masses of the all come out to be nice whole numbers?

The reason is this; the atomic masses given on your tables are "weighted averages" of the masses of the different naturally occurring isotopes of the element.

Let's look at an example.
Approximately 75% of the chlorine atoms found in nature have a mass of 35. The other 25% have a mass of 37. What should we report as the average atomic mass for chlorine?

What we do is to take the "weighted average" of these isotopes.

- You multiply the "relative abundance" percentage of an isotope by its specific isotope mass. Then you add to that number the next isotopes relative abundance percentage by its specific isotope mass. You keep doing that for each isotope that exists. The sum is the average atomic mass!
    - We multiply 35 times 75% and then add that to 37 times 25%...

$$(35\ x\ \ 0.75\ ) +\ (37\ x\ \ 0.25\ ) = 26.25 + 9.25 = 35.5\ amu$$

- So generally speaking we end up with the following equation:

$$Average\ Atomic\ Mass = \ (mass_1\ x\ \%_1\ ) +\ (mass_2\ x\ \%_2\ ) \ldots$$

GUIDED PRACTICE
NOTE: The numbers in each of the following problems have been made up. If we used actual percentages and masses of isotopes then you could simply look up the atomic weight of the element on the periodic table!

Suppose that there were 4 isotopes found of a new element. It was found that there was 7% of Isotope A with a mass of 93, 18% of Isotope B with a mass of 96, 34% of Isotope C with a mass of 97, and 41% of Isotope D with a mass of 99. What is the average atomic weight of this new element?

STUDENT PRACTICE:

1) Suppose that there were two isotopes of Sodium. 28% of the naturally occurring sodium atoms had a mass of 22, and 72% atoms had a mass of 23. What would the average atomic weight of sodium be?

2) Suppose that there were two natural isotopes of Copper. 80% of the atoms had a mass of 63, and 20% of the atoms had a mass of 65. What would that average atomic weight of copper be?

3) Suppose that a new element (E) were discovered that existed as three natural isotopes. 25% of the atoms had a mass of 278, 38% had a mass of 281, and the remainder had a mass of 285. What would be listed as the atomic weight of this element?

Dougherty Valley HS Chemistry
Isotopes of Pennies Activity

Worksheet #13

Name: **Period:** **Seat#:**

Pre-Activity Questions:

1) Read the background information provided below. Which pennies have more copper? Which have less copper?

2) What is an isotope?

3) Why are the masses on the periodic table not whole numbers, why aren't the masses just protons+neutrons?

4) What is the general equation used to calculate the Average Atomic Weight of a set of isotopes?

5) Rubidium has two common isotopes, 85Rb and 87Rb. If the abundance of 85Rb is 72.2% and the abundance of 87Rb is 27.8%, what is the average atomic mass of rubidium? Show your work.

6) Read the Instructions and Procedure section of this handout. Make sure you understand what you will be doing in class so you don't waste time!

Background: In 1982, the composition of a penny was altered to contain 20% less mass by substituting the less dense element zinc (Zn), in place of some of the copper in order to save money. According to the U.S. Mint,

Pennies dated 1962-1982:	Pennies dated 1982-present:
Composition: 95% copper, 5% zinc	Composition: 97.5% zinc, 2.5% copper

In this activity, a mixture of pre- and post- 1982 pennies will represent the naturally occurring mixture of two isotopes of the imaginary element "Coinium." The pennies will allow you to learn one way that scientists can determine the relative amounts of different isotopes present in a sample of an element.

Instructions:

1) You will be given a sealed container, which holds a mixture of ten pre-1982 and post-1982 pennies. You container might hold any particular combination of the two "isotopes." Your task is to determine the isotopic composition of the element "Coinium" ***without*** opening the container. In other words, what % of the sample is pre-1982 pennies and what % of the sample is post-1982 pennies?

2) An obvious, but important, notion is that the mass of the entire mixture equals the sum of the masses of all the pre-1982 and post-1982 pennies. The idea can be expressed mathematically as follows:

Total mass of pennies = (Number of pre-1982 pennies) * (Mass of one pre-1982 penny)
+ (Number of post-1982 pennies) * (Mass of one post-1982 penny)

The problem is that we don't know how many of each type of penny we have! That is what you are solving for. Just like when finding the abundance of atoms we can use percentages to our benefit!

Your goal is to find the value of:
x = the % of pre-1982 pennies
(1-x) = % of post-1982 pennies

3) Using the information above we can substitute in "x" and "1-x" to make a useful equation for us to use.
Total mass of pennies = (x * mass of pre-1982 penny) + ((1-x) * mass of post-1982 penny)

4) Since we know we have 10 pennies we can then convert from % of each type of penny to the NUMBER of each type of penny. Since this is all based on lab data, your numbers may not come out perfectly! You may need to use your judgement and round your final answers in a logical way.

Dougherty Valley HS Chemistry
Isotopes of Pennies Activity

Procedure:

1) Obtain a pre- and post-1982 penny and record their masses. Obtain and record the Unknown Sample # of a sealed container containing a total of 10 pennies. Weigh it and get the mass of an empty container from Mrs. Farmer.

2) Calculate the values of the % of pre-1982 pennies (x), and the number of post-1982 pennies (1-x)

3) Convert your % of each penny into the NUMBER of each penny.

4) Make sure you are showing your work for everything!

Unknown Sample #

Mass of Empty Container		**Mass of a Post-1982 Penny**	
Mass of Container + Pennies		**Mass of a Pre-1982 Penny**	
Total Mass of just Pennies *Show work*			
How many pre-1982 pennies are in your sample? *Show work*			
How many post-1982 pennies are in your sample? *Show work*			

Conclusion Questions Set

1) In what ways is the penny mixture a good analogy or model for actual element isotopes? Explain.

2) In what ways is the analogy misleading or incorrect? Explain.

3) Name at least one other familiar item that could serve as a model for isotopes. Support.

4) Using the following information, calculate the AVERAGE molar mass of naturally occurring copper. Naturally occurring copper consists of 69.1% copper-63 and 30.9% copper-65. The molar masses of the pure isotopes are:

copper-63 = 62.93 g/mol
copper-65 = 64.93 g/mol

Dougherty Valley HS Chemistry
Changes, Properties, Types of Matter, The Atom, and Avg. Atomic Masses
Extra Practice

Worksheet #14*

Name: **Period:** **Seat#:**

Directions: Any worksheet that is labeled with an * means it is suggested extra practice. We do not always have time to assign every possible worksheet that would be good practice for you to do. You can do this worksheet when you have extra time, when you finish something early, or to help you study for a quiz or a test. If and when you choose to do this Extra Practice worksheet, please do the work on binder paper. You will include this paper stapled into your Rainbow Packet when you turn it in, even if you didn't do any of this. We want to make sure we keep it where it belongs so you can do it later if you want to (or need to). If you did the work on binder paper you can include that in your Rainbow Packet after this worksheet. If we end up with extra class time then portions of this may turn into required work. If that happens you will be told which problems are turned into required. Remember there is tons of other extra practice on the class website…and the entire internet! See me if you need help finding practice on a topic you are struggling with.

Identify each as either a chemical or a physical change

1) Burning a log	**2)** Bending a wire of Aluminum	**3)** Boiling water	**4)** Melting copper
5) Water evaporating from sugar water	**6)** Digesting your lunch	**7)** Grinding sand	**8)** freezing water to make ice
9) Water is absorbed by a paper towel	**10)** A piece of Li is dropped into water and catches fire producing LiOH	**11)** A pellet of sodium hydroxide is sliced in two	**12)** Salt dissolves in water
13) Milk sours	**14)** zinc reacting with hydrochloric acid producing a gas	**15)** Iron rusting	**16)** A decaying tree trunk

Identify each as either a chemical or physical property

17) Magnetic	**18)** Red color	**19)** Dissolves in water	**20)** Density
21) Malleable	**22)** Reacts violently with Na	**23)** Soluble in alcohol	**24)** Mass
25) Temperature	**26)** Length	**27)** Odor	**28)** Flammable

Identify each as either a pure substance, homogeneous mixture, or heterogeneous mixture

29) Salami	**30)** Dirt	**31)** A burrito	**32)** Iron filings
33) Steam	**34)** Pepsi	**35)** Italian Dressing	**36)** The gas inside a balloon blown up by mouth
37) Salt water	**38)** Silver	**39)** Chicken soup	**40)** The gas inside a balloon filled with helium
41) Graphite in a pencil (carbon)	**42)** Orange juice with pulp	**43)** Kool-aid	**44)** Blood

Fill in the missing items in a table like the one below

	Name	Symbol	Z, A, # p, # e, # n	Isotopic Symbol
45)		P^{3-}		
46)	Iron			
47)			#p = 53	
48)	Silver			
49)			Z = 36	
50)		W		
51)	Magnesium Ion (+2 charge)			
52)			#p = 2	
53)		Mn		
54)	Bromine			

Dougherty Valley HS Chemistry
Changes, Properties, Types of Matter, The Atom,
and Avg. Atomic Masses
Extra Practice

Solve the following problems related to average atomic masses:

55) What is the generic equation for calculating average atomic masses?

56) Argon has three naturally occurring isotopes: argon-36, argon-38, and argon-40. Based on argon's reported atomic mass, which isotope exist as the most abundant in nature? Explain

57) An unknown element has three naturally occurring isotopes in the universe with masses of 201.97 (71.6%), 200.76 (14.4%) and 199.99 (14.0%). What is the atomic mass of the element?

58) Strontium consists of four isotopes with masses of 84 (abundance 0.50%), 86 (abundance of 9.9%), 87 (abundance of 7.0%), and 88 (abundance of 82.6%). Calculate the atomic mass of strontium.

59) Naturally occurring europium (Eu) consists of two isotopes was a mass of 151 and 153. Europium-151 has an abundance of 48.03% and Europium-153 has an abundance of 51.97%. What is the atomic mass of europium?

60) Calculate the average atomic mass of magnesium using the following data for three magnesium isotopes.

Isotope	***mass (amu)***	***relative abundance***
Mg-24	23.985	78.70%
Mg-25	24.986	10.13%
Mg-26	25.983	11.17%

61) Calculate the average atomic mass of sulfur if 95.00% of all sulfur atoms have a mass of 31.972 amu, 0.76% has a mass of 32.971amu and 4.22% have a mass of 33.967amu.

62) The four isotopes of lead are shown below, each with its percent by mass abundance and the composition of its nucleus. Using the following data, first calculate the approximate atomic mass of each isotope. (Assume that each proton and neutron has a mass of 1.00 amu. Disregard the mass of the electrons.) Finally, calculate the average atomic mass of lead.

82p	82p	82p	82p
122n	124n	125n	126n
1.37%	26.26%	20.82%	51.55%

63) There are three isotopes of silicon. They have mass numbers of 28, 29 and 30. The average atomic mass of silicon is 28.086amu. What does this say about the relative abundances of the three isotopes?

64) Calculate the average atomic mass of bromine. One isotope of bromine has an atomic mass of 78.92amu and a relative abundance of 50.69%. The other major isotope of bromine has an atomic mass of 80.92amu and a relative abundance of 49.31%.

65) Calculate the atomic mass of an element if 60.4% of the atoms have a mass of 68.9257 amu and the rest have a mass of 70.9249 amu. Identify the element in the periodic table.