Name _____ Period. _____

Chem RG Chapter Packet 2 – Matter & Energy; Mr.Nogales

Score
Peer Review/corrected score

Assign	Section #	Name		
1.		Assignment Sheet printed (10 pts)		
2.		Notes 2.1 (10 pts)		
3.		Notes 2.2 (10 pts)		
4.		Notes 2.3 (10 pts)		
5.	2.1	WS1.2 Metric Units I / Physical vs. Chemical (10 pts)		
6.	2.3a	WS 1.3 significant Figures I (10 pts)		
7.	2.3b	WS 1.7 Metric Units II (Conversions) (10 pts)		
8.		Unit Conversion Tutorial Part 1 (10 pts)		
9. Section and End of Chapter Summaries using Costa's Levels of Thinking (25 pts)				

(Total Points = 105 pts

EVIDENCE (after you take notes.) You should have at least 4 types of evidence for each set of notes.

1. Number new concepts	1,2,3…/A,B,C…	2. Delete/Cross out unimportant information	~~Unimportant~~
3. Circle vocab/key terms	Key Terms	4. Identify points of confusion	?
5. Underline/Highlight main Ideas	Main Ideas	6. Identify information to be used on a test, essay…	*
7. Fill in gaps of information. Reword or paraphrase.	^	8. Create visuals/symbols of important information	Visuals/symbols

Notes:

1. Your lab report is turned in by itself and receives a separate grade.(+50 pts)
2. You will peer edit and have your editor record a score based on your work.
3. For each section, you need to use 2-3 Costa's Levels of Thinking(CLOT)questions and answer the questions.
4. Extra credit for doing at least 4 types of evidence (below) for each set of notes/annotate (10 pts).
5. Please note that if you are required to show work, and you do not show your work, you will not receive credit.
6. There is no test review for this chapter. Study your notes.

Ch 2 Accuracy & Precision in Measurement

(You must write-up your lab in your lab notebook)

OBJECTIVES

- **Use** experimental measurements in calculations.
- **Organize** data by compiling it in tables.
- **Compute** average value from class data & use it to calculate absolute deviation and average deviation.
- **Recognize** the importance of accuracy and precision in scientific measurements.
- **Relate** the reliability of experimental data to absolute deviation, average deviation, uncertainty, & percent error.

INTRODUCTION: You will determine the volume of a liquid in two different ways and compare the results. You will also calculate the density of a metal using your measurements of its mass and volume.

$$D = \frac{m}{v}$$

The *experimental error* is calculated by subtracting the accepted value from the observed or experimental value. The *percent error* is calculated according to the following equation.

$$\text{Percent error} = \frac{(\textit{Observed value} - \textit{Accepted value})\ (100)}{\textit{Accepted value}}$$

You will average the values for the density of a metal obtained by the entire class to determine the average value. Using this value you will calculate the *average deviation* of these data expressed as the *uncertainty*.

SAFETY: **Always wear safety goggles and a lab apron to protect your eyes and clothing.**

MATERIALS • 15 cm plastic ruler • 25 mL graduated cylinder • 100 mL beaker • balance
• 100 mL graduated cylinder • metal shot (aluminum, copper, lead) • thermometer, nonmercury, 0–100°C

PROCEDURE: After completing each part of the experiment, record your observations in the appropriate data table.

PUT YOUR DATA TABLES (ALL 3 OF THEM) ON THE <u>RIGHT</u> SIDE OF YOUR LAB BOOK.

1. **a.** Examine the centimeter scale of the plastic ruler. What are the smallest divisions?
   b. To what fraction of a centimeter can you make measurements with such a ruler?

2. Using the ruler, measure the inside <u>diameter</u> of the 100 mL graduated cylinder. Also, measure the inside <u>height</u> of the cylinder to the 50 mL mark. Record these measurements in Data Table 1.

DATA TABLE 1

Inside diameter of graduated cylinder	_____ mm
Inside height of graduated cylinder	_____ mm

3. Examine the gram scale of the balance.
   a. What are the smallest divisions?
   b. To what fraction of a gram can you make measurements with a centigram balance?

4. Examine the lines on a 25 mL graduated cylinder
   a. Find the smallest fraction of a milliliter to which you could make a measurement.
   b. Does this match the uncertainty of a measurement made with a 100 mL graduated cylinder?
5. Using the balance, determine the mass of the dry 25 mL cylinder. Record the mass in Data Table 2.

6. Fill the beaker half full of water and determine its temperature to the nearest degree. Look up the density of water for this temperature, and record both the temperature and water density in Data Table 2.

7. a. Fill the cylinder with water to between 10 and 25 mL; accurately read & record the volume.
b. Find the mass of the water plus the cylinder. Then, record this value in Data Table 2.
c. Save the water in the graduated cylinder for use in Step 8.

DATA TABLE 2

Mass of empty graduated cylinder	_____ g
Water temperature	_____ °C
Water density	_____ g/cm^3
Water volume	_____ mL
Mass of graduated cylinder with water	_____ g

8. Add enough metal shot to the cylinder containing the water (saved from Part 2) to increase the volume by at least 5 mL. Determine (a) the volume and (b) the mass of the shot, water, and cylinder. Record your measurements in **DATA TABLE 3** (just below):

Water volume from step 7	_____ ml
Mass water + graduated cylinder from step 2	_____ g
Volume metal & water	_____ ml
Mass of metal + water + graduated cylinder	_____ g

CLEANUP AND DISPOSAL: Clean your pod, equipment and put away equipment.

WRITE-UP:
Title, Date, Name, Partner's Name, "Carbons", Observations, Calculations, Questions, Conclusions

OBSERVATIONS: Put your observations from the lab in this section of your final write-up.

CALCULATIONS: Show all your calculations. Place your answers in the appropriate calculations table.

1. Calculate the volume of the cylinder to the 50.0-mL graduation ($V = 3.14 > r^2 > h$).
2. Calculate the mass of water as measured by the balance.
3. Calculate the mass of the water from its measured volume and its density ($m = D > V$).
4. Determine the metal's volume using your measurement of the volume of water displaced by the metal.
5. Using your measurements in Data Table 3, determine the mass of the metal.
6. Calculate the density of the metal.
7. Record three values obtained by you and your classmates for the density of the same metal.
Your group's density _____g/cm^3 Group 2 _____g/cm^3 Group 3 _____g/cm^3
8. Calculate the average density of these 3 values.

QUESTIONS
1. What value of a measurement must be known if trying to determine the accuracy of your measurements?
2. List 2 possible sources of experimental error in this lab.
a.
b.

CONCLUSIONS
Sarah and Jamal determined the density of a liquid three times. The values they obtained were 2.84 g/cm^3, 2.85 g/cm^3, and 2.80 g/cm^3. The accepted value is known to be 2.40 g/cm^3.
a. Are the values that Sarah and Jamal determined precise? Explain.
b. Are their values accurate? Explain.

HC Ch 2 Matter and Energy

Section 1 - Energy - standards

- Explain that physical & chemical changes in matter involve energy transfer
- Distinguish between heat and temperature
- Convert between Celsius and Kelvin temperature scales.

Energy

The ability to do _____. Work - causes a _____or _____an object.

Many types - all can be changed into the other. Every change in matter involves a change in _____.

Physical Change - involves energy

Changes the _____of a substance without changing its _____. Properties remain the _____
Example is evaporation - steam is still water

Chemical Change - involves energy

changes the _____of a substance. Products have _____properties
Examples:
rusting iron burning a log grinding spices
dissolving in water melting ice

Physical vs. Chemical

Signs of a Chemical Change
change in color or odor formation of a precipitate (solid)
formation of a gas change in
light or heat

Endothermic Reaction - _____energy. Exothermic Reaction - _____energy

Conservation of Mass

Mass cannot be _____in _____ (not nuclear) changes.

Conservation of Energy

Energy cannot be _____in ordinary changes (not nuclear), it can only change form.

Types of Energy

Potential - stored energy

Kinetic Energy - energy something has because its _____

Heat - the energy that moves because of a _____ _____.

Chemical energy - energy released or absorbed in a _____change.

Electrical energy - energy of _____

Radiant Energy - energy that can travel through _____ (light, UV, infrared, radio)

All types of energy can be _____into others.

If you trace the source far enough back, you will end up at _____energy.

Heat

Energy transferred between objects at _____temperatures. Energy can be _____as heat.

Heat is _____than temperature.
A drop of boiling water hurts. A bathtub of boint water can kill. Same temperature . . . Different heat.

Measuring Temperature

Use Celsius scale (but SI in Kelvin).
Water freezes at 0ºC. Water boils at 100ºC
Body temperature 37ºC/ Room temperature 20 - 25ºC
Kelvin starts at absolute zero (-273º C)
Degrees are the same size
C = K - 273
K = C + 273

Kelvin is always _____ (good tip). Kelvin can never be negative.

Measuring Temperature

What is 30º C in Kelvin? _____. What is 60 Kelvin in ºCelsius? _____

Heat Transfer May Not Affect Temperature

When ice melts the heat goes into _____ the ice _____ changing the _____.

Temperature of melting ice stays _____.

Once the ice has _____ melted, adding _____ heat then changes the _____ temperature.

Same thing with water _____. No temperature change _____ it has all boiled.

Specific Heat

Different substances have different capacities for storing energy
It may take 20 minutes to heat water to 75°C. However, the same mass of aluminum might require 5 minutes and the same amount of copper may take only 2 minutes to reach the same temperature.
Specific heat is the amount of heat needed to raise the temperature of 1 g of a substance by 1°C

	J/g°C
water	4.184
aluminum	0.90
copper	0.39
silver	0.24
gold	0.13
iron	0.449

Learning Check

$q = m \bullet \Delta t \bullet Cp$

where q => heat, J. m => mass, g. Δt = change in temperature, ^{o}C. Cp => specific heat, $J/g\bullet^{o}C$

Heat Calculations

A hot-water bottle contains 750 g of water at 65°C. If the water cools to body temperature (37°C), how many joules of heat could be transferred to sore muscles?
$q = m\bullet\Delta t\bullet Cp$ (Show your calculation here)

Answer._____

It takes 102 joules to heat 15.4 g of a metal from 22.0 ºC to 33.0ºC. What is the specific heat of the metal? ($q = m \bullet \Delta T \bullet C_p$). What metal is it? (see Table 1, p. 60)
SHOW YOUR WORK HERE

Answer _____

Iron has a specific heat of 0.449 J/gºC. How much heat will it take to change the temperature of 48.3 g of iron by 32.4ºC? Answer . . .?
SHOW YOUR WORK HERE

Answer: _____

2.2 Studying Matter & Energy - Standards

- Describe the scientific method
- Explain the purpose of controlling the conditions of an experiment
- Differentiate between a hypothesis, a theory, and a lawScientific Method

Scientific Method

Model - Explanation of _____phenomena occur. Not real.

Theory - Broad generalization that _____a body of facts or phenomena.

Hypothesis- an _____as to the cause of the problem or answer to the question.

Experiment- designed to _____the hypothesis Generates data observations from experiments.

Modify hypothesis - repeat the cycle Cycle repeats many times.

The hypothesis gets more and more _____. Becomes a _____

Theory can never be _____. Useful because it _____behavior

Helps us form mental pictures of processes (models)

Another outcome is that certain behavior is repeated many times

_____is developed, which is a description of _____things _____

Law - _____. Theory - _____

2.3 Measurements & Calculations

- Distinguish between accuracy & precision
- Determine correct significant figures
- Calculate changes in energy using the equation for specific heat and round to correct sig figs
- Write numers in scientific notation
- Start using Dimensional Analysis

Types of measurement

Quantitative - use _____to describe Qualitative - use description _____numbers

Which are the following? 4 feet_____. Extra large_____

System: what's being _____ . Surroundings: _____

Accuracy vs. Precision

Accuracy - how close a measurement is to the _____

Precision - how close a series of measurements are to _____

Significant Figures

Indicate _____of a measurement.
Sig figs in a measurement include the known digits plus a final _____digit

Counting Sig Figs

Count all numbers EXCEPT:
Leading zeros -- 0.0025. Trailing zeros without a decimal point -- 2,500

How many sig figs in the following values?

458 g _____	0.0485 g_____	40.004085 g_____
4085 g _____	0.04850 g_____	250 pencils_____
4850 g _____	0.004085 g_____	

Atlantic/Pacific Rule pp

Decimal point "present" - "pacific ocean". Decimal point "absent" - "atlantic"
Draw a line through the "leading" zeroes until get to the first non-zero number.
Everything else is significant.
Only measurements have sig figs. Counted numbers are exact (infinite significance)
A dozen is exactly 12 (counted, so ∞ s.f.) A paper is measured 11 inches (2 s.f.).
Classify each of the following as an exact (E) or a measured (M) number.

A.___Gold melts at 1064°C_____

B.___1 yard = 3 feet_____

C.___A red blood cell diameter 6 x 10^{-4} cm_____

D.___There were 6 hats on the shelf _____

E.___A soda can contains 355 mL of soda_____

Multiplying or Dividing with Sig Figs

The # with the _____sig figs determines the # of sig figs in the answer.
Chain is strong as its weakest link.
3.6 x 653 = (do on your calculator) . . . 2350.8 is the calculator answer, but . . .3.6 has 2 s.f. while 653 has 3 s.f. . . So, answer can only have 2 s.f. . . Round 2350.8 to 2400
Same rules for division.

Adding and subtracting with sig figs

The last sig fig in a measurement always is an estimate.
The answer when you add/subtract cannot be better than your worst estimate.
So, have to round it to the number with the _____ decimal value.

Scientific notation: Must have same exponents to add or subtract.

Converting into Sci. Notation:

Move decimal until there's 1 digit to its left. Places moved = exponent.
Large # (>1) ⇒ positive exponent Small # (<1) ⇒ negative exponent
Only include sig figs in final answer.

Scientific Notation without a calculator (district/state tests)

Adding/Subtracting - only if the values have the same exponent.
Multiplying - add the exponents. Dividing - subtract the exponents.

Problem solving

1. Analyze: Identify the _____ . Both in words and _____ it will be measured in.
   May need to read the question several times. Identify what is _____
   Write it down. Maybe draw _____.
   Unnecessary information may also be given.
   Try it with the _____ _____ program

2. Plan a solution
Break it down into steps. Look up needed information.

3. Compute - cancel units, sig figs

4. Evaluate
   Sig Figs correct. Units correct. Check your work. Reread the question, did you answer it?
   Is it reasonable? Estimate (check order of magnitude)

Using Conversions with Dimensional Analysis

The "Factor-Label" Method/Dimensional Analysis
Units, or "labels" are canceled, or "factored" out.

1. Identify starting & ending units.
2. Line up conversion factors so units cancel.
3. Multiply all top numbers & divide by each bottom number.
4. Check units & answer.

WS 1.2 - Metric Units I / Physical vs Chemical

1. Fill in each of the blanks with an appropriate unit: **mm, cm, m, km, mg, g, kg, mL, L, kL**

A. Judy weighed her pen before and after class and found she had used 1.5 ___ of ink. **(mass)**

B. The empty fish tank weight about 7 ___, and it could hold 43 ___ of water.

C. The steak I had was huge! It was about 3 ___ thick and must have weighed at least 800 ___.

D. The anchored hot air balloon was about 35 ___ tall and held about 720 ___ of air.

E. The slot was just 1 ___ too short for the dime to pass through.

F. The standard archery arrow is 0.85 ___ in diameter, 0.72 ___ long and 0.045 ___ in mass.

G. It takes about 2 ___ of cayenne pepper on your tongue to make your mouth feel like it's on fire.

H. The 65 ___ man was so thirsty after running 13 ___ that he drank 1500 ___ of water.

2. Classify each as a **<Phy>**sical or **<Chem>**ical property:

_____ a. odor _____ b. color _____ c. flammability

_____ d. density _____ e. reaction to acids _____ f. melting point

3. Classify each as a **<Phy>**sical or **<Chem>**ical change:

_____ a. rusting of iron _____ b. boiling of water

_____ c. burning of sulfur _____ d. cooking an egg

_____ e. digestion of food _____ f. sawing of wood

_____ g. melting of wax _____ h. dissolving salt in water

_____ i. a leaf turning yellow _____ j. baking a cake

Ans (IRO+2): mg mg g g kg kg kg mL mL L kL mm cm cm m m km phy phy phy phy phy phy phy phy chem chem chem chem chem chem chem chem

~~Cross-off~~ answers as you find them. Then circle the 2 extras.

Section 2.3a

WS 1.3 Significant Figures I

For the following measurements, indicate how many significant figures (sf's) there are:

1) 34 g ___ 2) 564 L ___ 3) 19.3 mm ___ 4) 23.45 mg ___ 5) 101 km ___

6) 3400 g ___ 7) 5040 L ___ 8) 19,000 mm ___ 9) 20 mg ___ 10) 160 km ___

11) 0.00034 g ___ 12) 0.564 L ___ 13) 0.0019 m___ 14) 0.5 mg ___ 15) 0.12 km ___

16) 34.0 g ___ 17) 56.40 L ___ 18) 19.00 m ___ 19) 20.0 mg ___ 20) 8.200 m ___

21) 3400 g ___ 22) 2000 L ___ 23) 140 mm ___ 24) 19000 mg ___ 25) 6400 km ___

26) 800 g ___ 27) 800. L ___ 28) 10,900 mm___ 29) 10.090 mg ___ 30) 803 km ___

31) 1,000,000 g___ 32) 1,000,001 g___ 33) 0.05060 m___ 34) 56 mg ___ 35) 0 m ___

Ans #1-35 IRO: 1 1 1 1 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 4 4 4 4 4 4 4 5 7 ?

Indicate the # of sig figs for the following:

36) 3.4×10^3 g ___ 37) 5.64×10^8L ___38) 7×10^{-5}mm___39) 2.4×10^4 g ___ 40) 3.61×10^2 m___

41) 3.0×10^3 g ___ 42) 5.60×10^8 L___43) 2.04×10^4 g___44) 6.00×10^2 g___ 45) 2.0×10^0 m ___

Ans #36-45 IRO: 1 2 2 2 2 3 3 3 3 3

Convert between scientific notation and regular notation, without changing the number of sig fig's:

46) 5700 g = 5.7×10^3 g

47) 14,000,000 m = _____ m

48) 2,000 cm = _____ cm

49) 2,000. cm = _____ cm

50) 0.000043 kg = _____ kg

51) 0.000230 mg = _____ mg

52) 3.6×10^5 m = 360000 m

53) 3.6×10^{-5} m = _____ m

54) 3.60×10^5 m = _____ m

55) 6.00×10^1 kg = _____ kg

56) 6.00×10^2 kg = _____ kg

57) 3.25×10^3 L = _____L

Ans #46-57 IRO: 4.3×10^{-5}, 0.000036, 2.30×10^{-4}, 60.0, 600., 2×10^3, 2.000×10^3, 3250, 360000, 1.4×10^7

Round each of the following off to the specified number of sig fig's: (some have been done for you...)

58) Round 78.241 g to... 4 sf: 78.24 3 sf: _____ 2 sf: _____ 1 sf: _____

59) Round 4.2983 g to... 4 sf: _____ 3 sf: 4.30 2 sf: _____ 1 sf: _____

60) Round 373.99 g to... 4 sf: _____ 3 sf: _____ 2 sf: 370 1 sf: _____

61) Round 50,001 g to... 4 sf: _____ 3 sf: _____ 2 sf: _____ 1 sf: 50,000

Ans #58-61 IRO: 4 4.298 4.3 78 78.2 80 374 374.0 400 50,000 50,000 50,000

Use "King Henry died . . . "
M _ _ K H D d c m _ _ µ

WS 1.7 Metric Units II (Conversions)

Convert each of the following by dimensional analysis: for full credit, show all steps:

1) 25.2 cm = _____ m

2) 25.2 cg = _____ g

3) 25.2 km = _____ m

4) 25.2 mL = _____ L

5) 25.2 cm = _____ mm

6) 25.2 g = _____ µg

7) 0.023 µL =_____ cL

8) 0.023 kg = _____ cg

9) 0.023 m =_____ mm

10) 4500 µm =_____ Mm

11) 4500 dL =_____ µL

12) 4500 dg =_____ kg

Use this area for scratch paper if needed

Ans (IRO+3): 252 0.0252 0.252 25,200,000 2.52 0.252 25,200
2300 23 0.000 002 3 2300
450 0.000 000 004 5 450,000,000 0.45

Unit Conv. Tutorial Part 1 Name: _____ Period: _____

- Go to the following website: http://joneslhs.weebly.com
- Click on the **Learn** button on the left. Read the 5-minute tutorial **first**. When you think that you understand the idea, go back to the Main Menu and click on One-S**tep Conversions** and complete this worksheet.

Read the directions on the first problem to see how to get started. Work through the challenging problems recording your answer below for each one. Don't forget units! Check your answers online on the website. SHOW YOUR WORK!

One Step Conversions

- For problems 1, 2, and 3 write down what the completed problem looks like. Cancel the units that cancel. Circle the unit that doesn't cancel. Write down the answer to the problem.

1. _____ =

2. _____ =

3. _____ =

For problems 4-9, you can just write down the answer once you have solved it.

4. Calculated Answer:
5. Calculated Answer:
6. Calculated Answer:
7. Calculated Answer:
8. Calculated Answer:
9. Calculated Answer:

For problem 10, solve it on paper here. **Then type in the calculated answer to see if you are correct**.

10. Solved problem and answer: