Name:

Regents Chemistry: Mr. Palermo

Practice Packet

Unit 1: Math and Measurement

How Does Chemistry Affect Me? Why Do I Have to Take This Class?!?

Read the article on the following page and respond to it by answering the questions below.

The article contains over 30 questions or "I wonder" statements.

1) Underline or highlight as many as you can find.

2) List the 5 questions that you think are the most interesting (the ones that you want to know the answer to the most).

3) Think about what you did to get ready for school today. Brainstorm at least one similar question you have.

Hopefully you see just how many things you do each day that relate to Chemistry. As we progress through the year we will have answered many of these questions, as well as posed many new questions to answer!

Why Study Chemistry Anyway?

Man, there's my alarm. Five-thirty, the morning I've dreaded all week- the first day of school. I should get ready and get there. Where's that toothpaste? I wonder why fluoride is in there. There's baking soda and peroxide too. Why would they put those in toothpaste? It's time for a shower. I wonder why soap and water clean so much better than just plain water. How is shampoo different from soap? I wonder why I feel so cold before I dry off. There's isobutane in this hair stuff. I wonder if that's anything like the butane in lighters. Why would something like that be in this hair styling stuff?

It's time for some tunes. The news is on. There's an air quality advisory for late in the day. I wonder what ozone is? How does it get into the air? Why is it a problem? They keep telling us not to stay out in the sun too long because the ozone layer is disappearing. How can it just disappear, and how is the ozone layer different from the ozone they tell us we shouldn't breathe? I wonder how sunblock works.

I had better turn on the light. I wonder what's in a light bulb that lets it get so hot and still not melt or catch on fire. It's time to check the laundry and get dressed. How does a detergent work? Where's that tie-dyed T-shirt. I wonder how they tie-dye clothing. How do dyes stay on the clothes without coming off onto my skin? Boy, these jeans are really faded. I wonder what made them fade so much. My socks came out nice and white. What is bleach, and how does it work? My new sneakers sure are comfortable. I wonder how they made that foam rubber.

I should fuel up with some breakfast. Maybe I'll fry an egg. How does cooking change the egg? It's getting late; I'll just have some orange juice and cereal. Wait, every time I drink orange juice after I brush my teeth, it tastes really strange. I wonder why that is. I think I'll just try the cereal and skip the juice. I know it has vitamin C, but what does that do for me anyway? This cereal is "fortified with iron". I wonder what kind of iron they put in there; it couldn't be those iron filings we used in science class, could it? The milk says it has vitamin D added. I wonder what vitamin D is and why it's good for me. There's the calorie count. I wonder if that has anything to do with those energy measurements we read about in biology. Time to leave for school. I hope the car starts this morning. I wonder how a battery works. Oh great, the car needs gas. I'll pull in to the mini-mart and fill up the tank. The pump says something about an octane rating. I wonder what octane is and what that octane rating really means. This gas has 10% ethanol added. Why would they add ethanol to gasoline anyway? It looks like that tire is a little low. This pressure gauge is reading lower than it did yesterday afternoon. I wonder if it's because it's so much cooler this morning.

Before I leave, I think I'll get a can of soda. Oops, I dropped it; I better not open it until later. I wonder what those bubbles are and how they get them in there. I made it to school on time. It's supposed to be really hot today. I've heard of car windows popping when it gets really hot, so I'd better open them a little bit. I wonder why they sometimes break when the car gets really hot. I'm glad the windows are coated to shade the inside. That should help, too. I wonder what that coating is, and how they get it in the glass. It sure is bright out this morning; I'm glad my glasses darken in the sun. I wonder how they do that. The air conditioning sure will feel good this afternoon. I'm glad I had my air conditioner fixed. What is the refrigerant that the mechanic refilled? I wonder how air conditioning works. Well, here I am in Chemistry class. I hope we learn something today. When will I ever use chemistry in my everyday life? What good is it to me? Why can't I study something that I can use?

Reference *Barker, G. Kenneth Jr. 2000 Journal of Chemical Education Vol. 77 No. 10*

Lesson 1: Metric Conversions

Objective:

- ***Define chemistry, matter and differentiate how matter can be described.***
- ***Convert between units of measurement***

Use Reference Tables C and D to help you answer the following questions about the metric system.

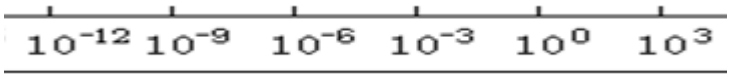
1. Give the unit used to describe the following:

   a. Mass _____ d. Time: _____

   b. Volume _____ e. Temperature: _____

   c. Energy _____ f. Pressure: _____

2. Complete the following number line by adding the prefixes that pertain to the marked values:



3. If a substance weighs 2.00 grams and you need the mass in kilograms, will the number appear to become smaller or larger? Explain your answer.

4. If a liquid has a volume of 5800 mL and you need the mass in Liters, will the number appear to become smaller or larger? Explain your answer.

5. If a substance has a mass of 0.00235 grams and you need the mass in milligrams, will the number appear to become smaller or larger? Explain your answer.

6. Convert the following:

a. 900 km	=	_____ m	h. 568 mm	=	_____ m
b. 200 kg	=	_____ g	i. 52 mg	=	_____ g
c. 5.00 m	=	_____ km	j. 0.025 J	=	_____ mJ
d. 7000 J	=	_____ kJ	k. 0.859 s	=	_____ ms
e. 800 cm	=	_____ m	l. 0.0256 m	=	_____ um
f. 20 cg	=	_____ g	m. 0.000589g	=	_____ ng
g. 2.0 L	=	_____ cL	n. 0.00005987 m	=	_____ pm

Additional Practice:

1. Determine the number of mm in 1600 m.

2. Determine the number of m in 1600 mm.

3. Determine the number of mm 14.3 cm.

4. Convert 5.2 cm of MG ribbon into mm of ribbon.

5. Convert 0.049 kg of sulfur to g.

6. Convert 0.020kg of tine to mg.

7. Convert 150mg of aspirin to g of aspirin.

8. Convert 2500 mL of HCl to L of HCl.

9. Convert 4.75 cm to m.

10. Convert 5.698 Kg to mg.

Lesson 2: Density

Objective:

- ***Determine the volume of a substance***
- ***Calculate Density/Mass/Volume***

For each problem below, write the equation and show your work. Always use units and box in your final answer.

1. Reference table S gives the densities of many elements. Which of the first 10 elements is the least dense?

2. Generally, what phase of matter (solid, liquid or gas) has the lowest density? Highest?

3. 4. Bubbles in soda rise to the surface. Explain this in terms of density.

4. The density of silver (Ag) is 10.5 g/cm^3. Find the mass of Ag that occupies 965 cm^3 of space.

5. A 2.75 kg sample of a substance occupies a volume of 250.0 cm^3. Find its density in g/cm^3.

6. Under certain conditions, oxygen gas (O_2) has a density of 0.00134 g/mL. Find the volume occupied by 250.0 g of O_2 under the same conditions.

7. Find the volume that 35.2 g of carbon tetrachloride (CCl_4) will occupy if it has a density of 1.60 g/mL.

8. The density of ethanol is 0.789 g/mL at 20^{oC}. Find the mass of a sample of ethanol that has a volume of 150.0 mL at this temperature.

9. 30.0 g of each of the following acids are needed. Find the volume of each that must be measured out in a graduated cylinder.

   A. hydrochloric acid (HCl), density = 1.164 g/mL

   B. sulfuric acid (H_2SO_4), density = 1.834 g/mL

   C. nitric acid (HNO_3), density = 1.251 g/mL

10. A rectangular block of lead (Pb) measures 20.0 mm X 30.0 mm X 45.0 mm. If the density of Pb is 11.34 g/cm^3, calculate the mass of the block.

11. A cube of gold (Au) has a side length of 1.55 cm. If the sample is found to have a mass of 71.9 g, find the density of Au.

12. An irregularly-shaped sample of aluminum (Al) is put on a balance and found to have a mass of 43.6 g. The student decides to use the water-displacement method to find the volume. The initial volume reading is 25.5 mL and, after the Al sample is added, the water level has risen to 41.7 mL. Find the density of the Al sample in g/cm^3. (Remember: 1 mL = 1 cm^3.)

Lesson 3: Temperature Conversions

Objective:

- ***Differentiate between Kelvin and Celsius scales***
- ***Translate (Convert) between Celsius and Kelvin temperature***

1) Convert -83 °C to Kelvin

2) How many Celsius degrees separate the freezing and boiling points of water? _____
What are these two temperatures? _____ & _____

3) What is the lowest possible temperature in °C? _____

4) How many Kelvin separate the freezing and boiling points of water? _____
What are these two temperatures? _____ & _____

5) What is the lowest possible temperature in Kelvin? _____

6) Using the temperature conversion formula on Table T in your Reference Tables, convert the following temperatures t
Celsius or Kelvin.

	383 K
80 °C	
	323 K
10 °C	
- 10 °C	
	243 K

Critical Thinking:

7) Why do you think that some calculations we will perform this year require you to convert Celsius temperatures to Kelvin? Explain.

8) Using Table S in your reference table what temperature does Sulfur melt at?

9) What temperature does Sulfur freeze at?

10) What is the freezing point of Silver (Ag)?

11) What is the boiling point of Mercury (Hg)?

12) If room temperature is 300 K, is Gallium a solid, liquid, or gas? Explain.

13) If room temperature is 22C, is Bromine a solid, liquid, or gas? Explain.

Lesson 4: Measuring Accuracy (Percent Error)

Objective:

- ***Differentiate between accuracy and precision***
- ***Calculate percent error***

1. What's the difference between accurate and precise?

2. You are playing darts with your friends and you are "up" next. All three of your darts hit the double bull (the VERY center of the target), but you weren't exactly aiming for the bulls eye. Would you say that you have high accuracy, high precision, or both? Explain your reasoning.

3. There are 140 calories in one can of Coke. In an experiment you determine that there are 210. You are a bit off, but what is your percent error for the experiment?

4. There are 35 mg of sodium in a can of Coke. You determine it to be 15 mg. What is your percent error?

5. There is 3.5 grams of fat in a granola bar. You determine the fat content to be 4.0 g in the lab. What is the percent error?

6. Working in the laboratory, a student finds the density of a piece of pure aluminum to be 2.85 g/cm^3. The accepted value for the density of aluminum is 2.699 g/cm^3.

7. A student experimentally determines the specific heat of water to be 4.29 J/g x C^o. He then looks up the specific heat o water on a reference table and finds that it is 4.18 J/g• C^o. What is his percent error?

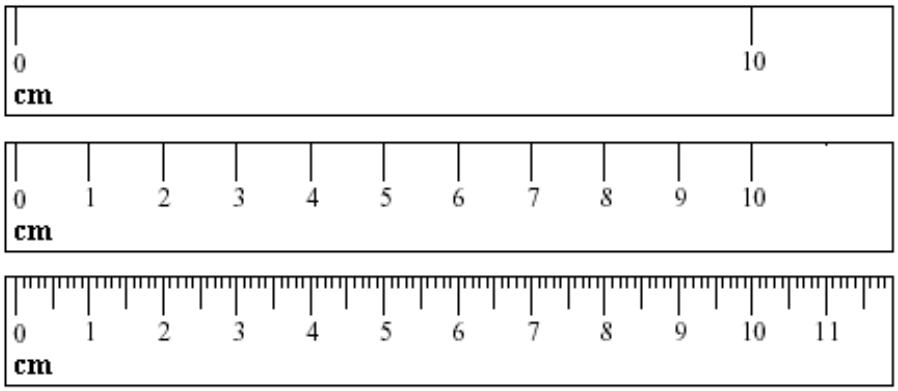
8. A student measures the volume of a substance to be 34.5 mL. What is their percent error for this measurement if the actual volume was 0.0250 L?

Lesson 5: Precision (Significant Figures in Measurement)

Objective:

- ***Identify the precision of a measuring device.***
- ***Identify the amount of significant figures in a number***

1. Measure the length of a paper clip on each ruler pictured below. The measurements will not be the same for each one, due to a difference in precision. Use the same paper clip for all three measurements and record your readings:



Length of Paper Clip

_____ **cm**

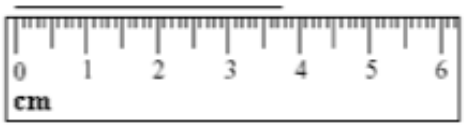
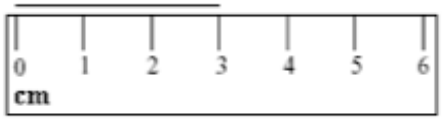
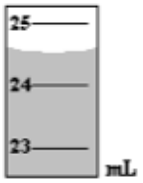
Length of Paper Clip

_____ **cm**

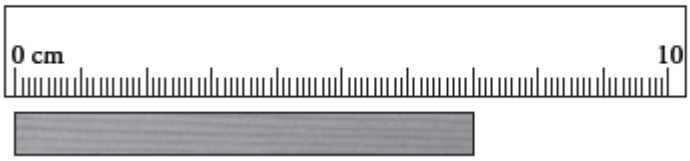
Length of Paper Clip

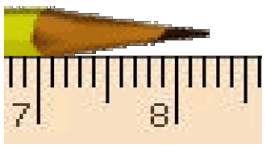
_____ **cm**

2) For the following measuring devices, record the reading, the precision (place) the measurement was made to and the number of significant figures in the measurement.

Example	Measurement	Precision (what place value did you estimate to?)
		
		
		

Record the length of the wooden splint to the proper number of significant digits.

3. 

4. 

5. A student finds the mass of a solid using 4 balances. Explain his findings in terms of precision and accuracy.

	Data
Mass 1	45.698 grams
Mass 2	45.7 grams
Mass 3	45.69842 grams
Mass 4	45.9 grams

6. A beaker has marks every 50mL. A cylinder has marks every 10mL. A pipette has marks every 1mL. Is the pipette the most accurate or precise tool? Explain your answer.

7. Sally measures 11mL of water in the beaker described in question 2. Henry measures 11mL in the pipette described in question 2. When they add their water together in one cup, do they have exactly 22mL combined? Why or why not?

In order to report the most precise and accurate data possible we must learn to count significant figures. When measuring a substances mass, volume, etc. the device requires you to measure "one place beyond." All the numbers you report count as a significant figure sig fig) except leading zeros and sometimes the trailing zeros. Let's investigate:

Example 1: A piece of aluminum has a mass of 0.0521 grams which had 3 sig figs. This is not 5 sig figs because if we convert that mass to mg the mass becomes 52.1 mg. Again the number has 3 sig figs which shows it didn't get any more precise. Proof that leading zeros never count.

Example 2: A beaker of water contains 520 mL which has 2 sig figs. The trailing zero doesn't count *this time* because if we convert to liters the volume is .52 L. The trailing zero was not measured. If we want to show that it was exactly 520 mL we would report it as 520. mL with a decimal point. That way if we convert to liters it is .520L.

Example 3: A reaction takes 0.0025050 s which has 5 sig figs. Remember the first three zeros are "place holders and don't count. If we convert to ms we get 2.5050 ms, also with 5 sig figs. The trailing zero was measured or else the student wouldn't have reported it. The rule is: **Leading zeros never count, trapped zeros always count they are measured) and trailing zeros count if there is a decimal.**

Using the rules above, count the number of significant figures in the following measurements:

1. 1.0 cm _____
2. 3.05 mm _____
3. 0.505 pm _____
4. 500 mL _____
5. 4.050 g _____
6. 2.500 kg _____
7. 0.0008 μg _____
8. 0.12 g _____
9. 0.000084 g _____
10. 9.9 g _____
11. 1000 ml _____
12. 4,100,000 mm _____
13. 3.020 g _____
14. 25.8 mL _____
15. 0.0000098 kg _____
16. 23.5°C _____
17. 9,001,000 μm _____
18. 12.560 g _____
19. 0.02300 kJ _____
20. 52 cm _____
21. 9.0803 nm _____
22. 350.230 g _____
23. 300 ml _____
24. 6.02×10^{23} m _____
25. 6.02×10^{5} L _____
26. 100.0 mL _____

Round each number to 3 sig figs

1. 98.473 L _____ L
2. 0.00076321 g _____ g
3. 57.048 m _____ m
4. 12.17 °C _____ °C
5. 124.5 g _____ g
6. 9.1305×10^{-2} m _____ m
7. 1.040555×10^{3} mm _____ mm

Lesson 6: Rounding with Sig Figs

Objective:

- ***Round answers to proper sig figs in calculations***

If a piece of glassware is very precise it may have a lot of sig figs, as many as 4. A less accurate piece of glassware such as a beaker will only have 1 sig fig. If both pieces of glassware are used to measure quantities in a lab we have to round our results to the least precise measurement. When working with measurements the quantity with the least decimal places is the least precise. For example, if the beaker measures 10mL and a cylinder measures 10.1mL the cylinder is more precise. If the two quantities are added together the new volume is 20mL. The decimal must be rounded to make our answer to one sig fig. Therefore the rule is: **When adding or subtracting measurements, round your answer to the lowest number of decimal places given.**

Complete the following operations and report to the correct number of significant figures.

1. 10.2 + 21 _____
2. 31.3 + 54.45 _____
3. 22.59 + 21 _____
4. 0.023 + 20.1 _____
5. 0.023 - 0.0004 _____
6. 5.068 - 0.1 _____
7. 45.6 - 22.12 + 11 _____
8. 0.0123 +5.689 – 0.014 _____

When performing calculations with our data sometimes we have to multiply and divide our data. In this case, the most precise answer is the one with the most sig figs. Since we need to round to our least precise measurement, we should round to the least number of sig figs given. For example, if the mass of a substance is 10.0 grams (3 sig figs) and the volume is 2 mL (1 sig fig) the density is 5 g/mL also (1 sig fig). The rule is: **When multiplying or dividing measurements, round your answer to the lowest number of significant figures given.**

Complete the following operations and report to the correct number of significant figures.

9. 5.87 * 2.1 _____
10. 4 * 78 _____
11. 0.0235 * 9 _____
12. 0.014 * 0.01 _____
13. 589 / 12 _____
14. 78.632 / 52.3 _____
15. 1569 / 24 * 2 _____
16. 596 * 32) / 22 _____

If both types of operations are used, always follow the multiplication rules least sig figs. Finally, in scientific notation, only the base number counts not the exponent or the 10. Use **PEMDAS!**

17. 22.1-10.0) / 2 _____
18. 12.35 / 4.56-2.14) _____
19. $6.23 \times 10^{-3} / 2.15 \times 10^{-4}$ _____
20. $2.1 \times 10^{2} - 1.4 \times 10^{1}) * 2$ _____

Rounding Significant Figures

Problem	Unrounded answer	Rounded answer
1. 1.2 m + 2.35 m =		
2. 2.6538 cm x 2.1 cm =		
3. 5.681 dm – 2 dm =		
4. 3845.2 m^3 ÷ 25.2354 m^3 =		
5. 25 cm + 3 cm =		
6. 1.2 m x 2 m =		
7. 859678.2354 cm – 568426.1 cm =		
8. 5.3 m x 5.2398 m x 2 m =		
9. 45.25252 nm + 45.8563 nm =		
10. 68.23 hm ÷ 38.255 hm		
11. 2.354 m + 2.354 m + 2.35 m =		

12. 0.28524 m x 0.25124 m x 1.235 m =		
13. 100 cm – 1.0 cm =		
14. 100 cm x 1 cm =		
15. 0.000456 m + 0.00524 m =		
16. 1254.1 cm ÷ 100 cm =		
17. 45.23547 g – 20.584 g =		
18. 1 L x 1.0 L =		
19. 0.00245 L + .234 L =		
20. 100,000 g ÷ 10.0 g =		

Lesson 7: Scientific Notation

Objective:

- ***Convert numbers into scientific notation and standard notation***
- ***Calculate mathematical operations using scientific notation***

Convert each of the following to scientific notation

Number	Scientific Notation
200	
250.	
1000	
200, 000	
2100.	

Convert each of the following to standard notation

Scientific Notation	Standard Notation
3.56×10^{3}	
7.982×10^{11}	
8.3400×10^{15}	
7.02×10^{-4}	
6.6×10^{34}	

1. $(8.97 \times 10^{4}) - (2.62 \times 10^{3}) =$

2. $(4.215 \times 10^{-2}) + (3.2 \times 10^{-4}) =$

3. $(3.4 \times 10^{6})(4.2 \times 10^{3}) =$

4. $(6.73 \times 10^{-5})(2.91 \times 10^{2}) =$

5. $(6.4 \times 10^{6})/(8.9 \times 10^{2}) =$

6. $(3.2 \times 10^{3})/(5.7 \times 10^{-2}) =$

REAL WORLD APPLICATION

Objective:

- ***Determine how measurement and units are important in every day life***

The New York Times **Health**

Baby Dies In Hospital, And Parents Plan to Sue

By BRUCE LAMBERT Published: February 09, 2002

He was their first child, and Ana and Giovanni Vargas feared they might lose him even before birth. Doctors discovered a heart valve defect and called the pregnancy high-risk. But little Gianni was born full-term by Caesarean section on Jan. 30, weighing almost 8 pounds.

Then his parents worried about whether he would survive delicate corrective heart surgery last Saturday. They were thrilled when the operation was declared a success and doctors said he would go home in a week or so.

But then a seemingly tiny mistake occurred while Gianni was recuperating in the neonatal intensive care unit of Stony Brook University Hospital in Stony Brook, N.Y. A missing decimal point in a prescription resulted in a tenfold overdose of intravenous potassium chloride, the Vargases said they were told by hospital officials, and Gianni died early Tuesday.

Only after Gianni's death did his mother and father hold him in their arms for the first time. ''I am angry because I was so close to bringing him home,'' Mr. Vargas said yesterday at a news conference. His wife, a native of the Dominican Republic who spoke through an interpreter, said she could not explain how she felt.

The couple, who live in Brentwood, appeared in the Lake Grove office of their lawyer, David Raimondo, and announced that they were filing a notice of claim as a prelude to a malpractice lawsuit for wrongful death.

The hospital acknowledged the infant's death, which Newsday reported yesterday, and ordered an immediate internal investigation. As required, it also notified the State Health Department, which started its own inquiry.

''We are sincerely sorry and extend to the grieving family our heartfelt condolences,'' said the hospital's director, Bruce Schroffel. ''We are conducting a thorough investigation of this baby's death to determine what steps are necessary to ensure that this will never happen again.''

Experts say that poorly written or carelessly read prescriptions are a common source of medical mistakes that harm patients. And among wrongly administered medications, potassium chloride is one of five most frequently involved, they say.

Gianni's prescription was supposed to be for 3.5 units of potassium chloride but instead was written as 35, the Vargases said they were told. They said they did not know who wrote the prescription.

Recommended preventive measures include the preparation of potassium chloride by hospital pharmacists instead of by nurses, and the use of computerized systems that automatically challenge prescriptions that appear to be inappropriate.

Stony Brook hospital declined to comment on whether it uses pharmacists to prepare potassium chloride and if it has a computerized prescription system. It did say that its procedures had called for checking medications at three different steps, and that in the aftermath of the fatality, hospital administrators doubled the number of staff members involved. The hospital would not say how many people that is.

''Medication errors are fixable, and there is no excuse for them occurring at the rate they are,'' said Arthur A. Levin, who was on the committee that wrote ''To Err Is Human,'' a 1999 report on medical mistakes written for the Institute of Medicine at the National Academy of Sciences..

The national group that reviews hospitals, the Joint Commission on Accreditation of Healthcare Organizations, named potassium chloride as a problem-prone medication in 1999. In another report last year on prescriptions, the group stressed the critical importance of the decimal point, especially in handwritten documents.

''Misinterpretation of such orders could lead to a tenfold dosing error,'' the report said.

Mr. Vargas married Ana after meeting her at their church. He said he is a construction union member and worked at ground zero from Sept. 15 until he was laid off on Dec. 17.

He and his wife chose Stony Brook because of its reputation for quality, he said. Many relatives have been treated there, including his sister, who gave birth a few weeks ago. But Mr. Vargas said that he and his wife do not intend to return.

1. What is believed to be the underlying cause of administering the wrong dosage?

2. Do you think leaving the units off the prescription could result in a similar tragedy?

3. Can you think of an over-the-counter medication that you take that could result in major medical problems or even death by mistakenly doubling or tripling the dosage? Give an example.