Honors Chemistry - Summer Assignment

This assignment is due on the first day of school. You must show all your work in all problems.

Honors chemistry is designed to be a prerequisite for any AP science. It will cover the nature of matter and energy and their changes, starting from a sub-atomic level and working our way up. The course focuses on how matter's large-scale properties and interactions can be predicted from the structure of protons and electrons. This is a science course that demands fundamental proficiency in algebra-based mathematics. You will solve a variety of problems numerically and algebraically. Equations are often used to explain patterns or trends instead of calculating a specific value.

It is not assumed that every student has taken biology first, so this assignment serves multiple purposes. First, it is a review of Algebra I by solving a variety of problems. The expectation is when an equation is needed, it can be solved for any variable. Other math skills will include graphing and scientific notation. Secondly, this serves as a starting place for all students regardless of what science course they have taken previously. It reviews topics covered in middle school to quickly cover the generic science tools so we can start the main course sooner.

Google Classroom:
Join the summer assignment Google Classroom using the code *jaiv5uj*. This platform is designed to provide you with comprehensive support. I will post reference videos and course materials for you to review and set recommended due dates as guidelines to help you divide the assignment. You can also send me questions, and I will reply as soon as I am able, ensuring you have the assistance you need.

If you have difficulties while completing this, review the videos in Google Classroom or find your own resources on the problem. Don’t be afraid to reach out to me with a question. I will be happy to assist you so that you are prepared for the start of class. There will be a quiz on this material during the first week of classes. I strongly recommend completing the assignment in small chunks throughout the summer. Completing it all in the first days of vacation risks forgetting things by August, but saving it all to the last minute risks forgetting concepts learned this past year.

Things to know about Honors Chemistry

1. Ignore your grade. You will do well if you focus on the content, do your work on time, and ask questions as often as needed.
2. Conceptual knowledge is more important than math. We will cover concept after concept, and to truly do well in the class, you need to be ready to apply that knowledge in different ways. We will continue to use topics covered at the beginning of the year throughout the course. This means you need to be involved in the course and study regularly. If you do so, you can build upon your knowledge and understand the concepts more deeply.

3. Do not cram. This is not a memory-based course. You will need to be able to combine multiple topics to solve one problem. Keeping up with the material and constantly using it helps keep everything fresh and easy to recall. Learn how to solve a problem, not just memorize the steps from one example.
4. Certain reference resources and equations will be provided during exams. It is more important to understand when, why, and how to use these resources than devote time to memorize something that can be looked up quickly. Calculators will also be allowed on exams. While a scientific calculator is sufficient for this course, I strongly recommend getting a TI-84 or better calculator, which will also meet all math class requirements for high school.
5. Outside resources are your friend. Assigned readings and videos are to help, and you need to do them. I will provide numerous resources for you, so if one does not make sense, try another one. Take notes while reading or watching videos to review later. Study the diagrams, graphs, and equations as well.
    a. Taking effective notes is the key to success in college. Every course and every teacher is different, so find a method that works best for you.
    b. Find your own resources! The internet is full of information, and you can find dozens of people all explaining the same topic. If you find something beneficial, send it to me, and I will share it with the rest of the class.
6. Work together as a class. Help each other out, bounce ideas off each other, and problem-solve together. Find a study group and share quizlets and videos. Use class time effectively. Socializing with friends may be fun, but you will have more work later.

Claim, Evidence, Reasoning

Claim, evidence, reasoning, or CER is a method for constructing a scientific argument. It can be used as part of a conclusion to a laboratory experiment or simply to answer a question about a phenomenon. A good scientific argument must be able to answer the question and provide a logical explanation supported by facts.

Claim:

- Answer to the question or your conclusion
- Clear, obvious, and addresses the question
- Should describe the relationship between independent and dependent variables
- One sentence

Bad Claim: Turbo-grow is the best fertilizer.

Good Claim: Turbo-grow is the best for tomato plants of the five fertilizers tested.

Evidence:

- Facts and data from the experiment relevant to the claim
- Provides support for your claim
- Can include qualitative and quantitative data or observations
- Just list the facts. Don't explain why it's important at this time.
- Must provide enough evidence to reach a conclusion, including data from all sides or trials tested to make a comparison. It is not enough to simply mention the prevalent claim.
- Should contain at least two pieces of evidence in 2-4 sentences

Example: The plants fertilized with Turbo-grow grew an average of 122 cm, while the Farm Fresh Fertilizer plants grew an average of 98 cm. The Turbo-grow plants were also darker green than the Farm Fresh Fertilizer plants.

Reasoning:

- Proof of your *claim* using *evidence* for support
- Must include and connect your claim and your evidence
- It must consist of one or more scientific principles, theories, laws, definitions, etc.
- Provide a logical explanation of how/why the evidence supports your claim.
- Typically starts with a summary of the most critical evidence and ends with restating the claim. It should feel natural to end with "...therefore [claim]."
- Define any terms (like "best")
- 2-4 sentences

Example: The best fertilizer was determined by the plants that grew the tallest and appeared to be the healthiest or most green. Since the plants fertilized with Turbo-grow were taller on average than the plants with other fertilizers and had a healthier green color, it can be concluded that Turbo-grow is the best of these fertilizers for tomato plants.

Find the Claim, Evidence, and Reasoning in the following paragraphs: Put (parentheses) around the claim, underline the evidence, and circle or highlight the reasoning.

1. Biology: A common type of asexual reproduction found in nature is called Mitosis. Mitosis requires less energy than sexual reproduction does. Mitosis can occur in seconds and does not require a mate to reproduce. Sexual reproduction requires two compatible parents. It also requires time to produce the egg and sperm cells and then for fertilization to occur. Energy is required to find a compatible mate, produce sex cells, and for fertilization. Therefore, Mitosis requires less energy than sexual reproduction does.

2. Physics: Cold air is more dense than hot air. When I filled a 9 centimeter diameter balloon with cold air, the mass was 1 gram, and when I measured the mass of the same size balloon with hot air, it was 0.5 grams. When molecules are cooled, they move closer together, and when the molecules are heated up, they move farther apart. Because of this, more molecules can fit into a balloon when the air is cold than when the air is warmer**.** The higher mass of cold air in the same size balloon supports the conclusion that cold air is more dense than hot air.

3. Chemistry: Fat and soap are two different substances. Fat is off-white in color and soft or squishy, while soap is milky white and hard. Fat is soluble in oil but not water, while soap is soluble in water but not oil. Fat has a melting point of 47°C, and soap's melting point is above 100°C. The density of fat is 0.92 g/mL, and the density of soap is 0.84 g/mL. All this shows that fat and oil have different properties. Since the properties of a substance are consistent, fat and oil must be different substances because they have different properties.

Write your own 1 paragraph CER (5-7 sentences) based on the data and information given. Then, put (parenthesis) around your claim, underline your evidence, and highlight your reasoning.

1. Sammy wants to see if plants really do grow better in sunlight. He uses 3 plants of the same type and size in 3 locations. Plant A is placed on his kitchen countertop in the center of the room, Plant B is placed inside a closet, and Plant C is placed on a window sill. After 5 days, Sammy measures the growth of each plant and documents it in the table below.

Sammy's Plant Growth Data		
	Height on Day 1	Height on Day 5
Plant A	12 cm	14 cm
Plant B	12 cm	13 cm
Plant C	12 cm	15 cm

2. Who has been stealing your Cheetos? You suspect Archie, Betty, or Reggie has been eating your Cheetos. You know that Cheetos dust will glow orange under a black light so after you notice some go missing, you bring the three of them into a room and turn off the lights. Under the black light, you see that Archie has a blue glow around his mouth, and Reggie has an orange glow on his fingers and mouth, but Betty shows nothing.

Scientific Notation

Regular Notation: The standard way of writing numbers
Ex: 280,000,000

Scientific Notation: A shorthand way of writing really large or really small numbers. Always written in the following form:

$$\#.\#\#\# \times 10^{P}$$

First Factor: a number that is always between 1 and 10. It may or may not be a decimal. In other words, it is always a SINGLE digit, followed by a decimal point, and then the rest of the number.

Power factor: The second part is always written as a power of 10. The exponent (P) is always an integer and tells you how many places to move the decimal. The sign of P indicates what direction to move the decimal. A positive power means the number is larger than one, while a negative power means the number is smaller than one.

Converting TO scientific notation:

- Count the number of places from your decimal to just BEHIND the first non-zero digit. This number becomes your power.
- If the decimal is moved left, the power will be positive. If the decimal is moved right, the power will be negative.
- Ex: $420{,}000. \rightarrow 4.2\text{x}10^{5}$ $0.00897 \rightarrow 8.97\text{x}10^{-3}$

Converting FROM scientific notation:

- Move the decimal right or left equal to the number of spaces indicated by the power. Fill in any empty places with zeros.
- If the power is positive, the decimal will move to the right. If the power is negative, the decimal will move to the left.
- Ex: $7.35\text{x}10^{8} \rightarrow 735{,}000{,}000$ $1.4\text{x}10^{-4} \rightarrow 0.000\ 14$

Scientific Notation

For each of the following, identify if the number is written correctly or incorrectly in scientific notation. Then, determine what rule applies to fixing the number.

1. 562.1×10^{8} Rule:
2. 4.9×10^{-3} Rule:
3. 7.8×8^{11} Rule:
4. 0.15×10^{-2} Rule:
5. 9.0×10^{5} Rule:
6. $3.451 \times 10^{5.5}$ Rule:
7. 8.245×10^{0} Rule:

Convert the following to/from scientific notation.

8. 4,700
9. 105.1
10. 0.001 52
11. 451,000,000,000
12. 0.000 056
13. 6×10^{3}
14. 5.2×10^{5}
15. 3.511×10^{-9}
16. 7.3×10^{7}
17. 9.5×10^{-10}

Solve each of the following problems. Express your answer in scientific notation.

18. $4.209 \times 10^{3} * 1.0 \times 10^{2}$
19. $3.1415 \times 10^{-5} - 9.1 \times 10^{-6}$
20. $4.6 \times 10^{8} * 7.222 \times 10^{-6}$
21. $6.54321 \times 10^{21} / 1.23456 \times 10^{15}$
22. $8.050 \times 10^{-18} + 7.31 \times 10^{-17}$

Metric Measurements, Units, and Conversions

You should be comfortable using and converting the following metric prefixes. Proper symbols for units, variables, prefixes, etc., are essential, as the wrong symbol could change the entire meaning. These symbols are CaSe SeNsItIvE. Capital and lowercase letters mean different things. You should have all six prefixes and all base units memorized.

Base Units

Measurement	Symbol	Unit [Symbol]
Length	L	Meter [m]
Time	t	Second [s]
Mass	m	Kilogram [kg]
Amount	n	Mole [mol]
Temperature	T	Kelvin [K]

Complete the following table:

Metric Prefixes

Metric Prefix	Symbol	Multiplier	Power
Kilo-	k	1,000	10^3
Hecto-			
Deca-			
Base Unit	-----	1	10^0
Deci-			
Centi-	c	0.01	10^{-2}
Milli-			

Name the following units

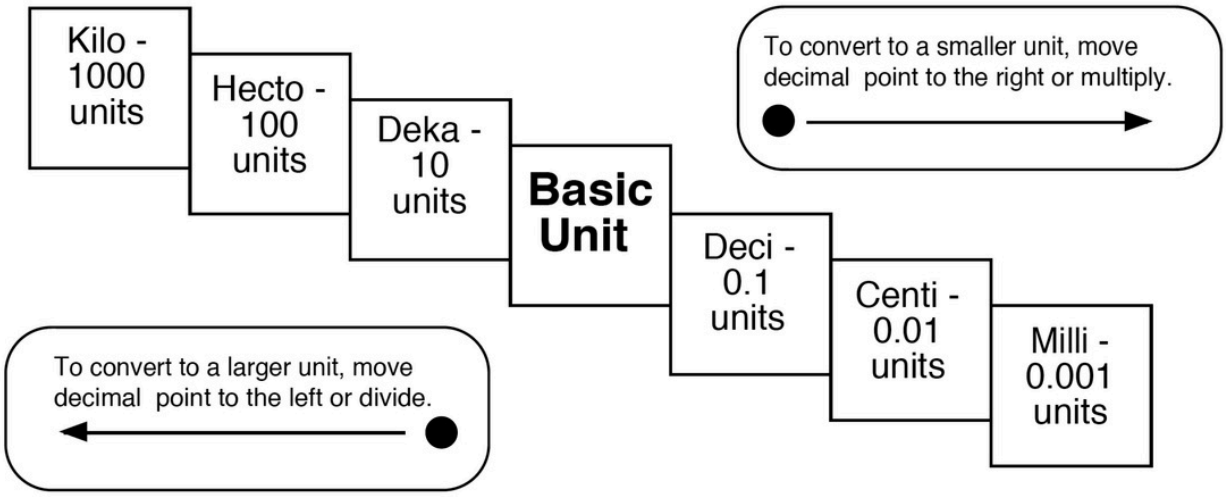
1. hm
2. ks
3. mmol
4. Dag
5. dm

Write the symbol for the following units

6. Decigram
7. Millimeter
8. Centisecond
9. Decameter
10. Hectogram

To convert between units, simply determine the factor of ten and move the decimal place on the measurement accordingly.

- When you move towards a smaller unit, the decimal place should move to the right.
- When you move towards a larger unit, the decimal place should move to the left.



Convert each given metric unit to the desired one.

1. An Olympic-sized swimming pool contains 2,500,000 liters (L) of water. How many kiloliters is this?

2. The speed of light is 299,792,000 m/s. What is the speed in km/s?

3. Microwaves are electromagnetic waves. If a particular microwave has a wavelength of 55 cm, what is this length in millimeters?

4. A gold bar has a mass of 12.4 kg. What is its mass in milligrams (mg)?

5. The human brain has an average mass of about 1,400 g. What is this mass in kilograms and milligrams?

Data Analysis

Determine the mean, median, mode, maximum, minimum, and range for the following data sets.

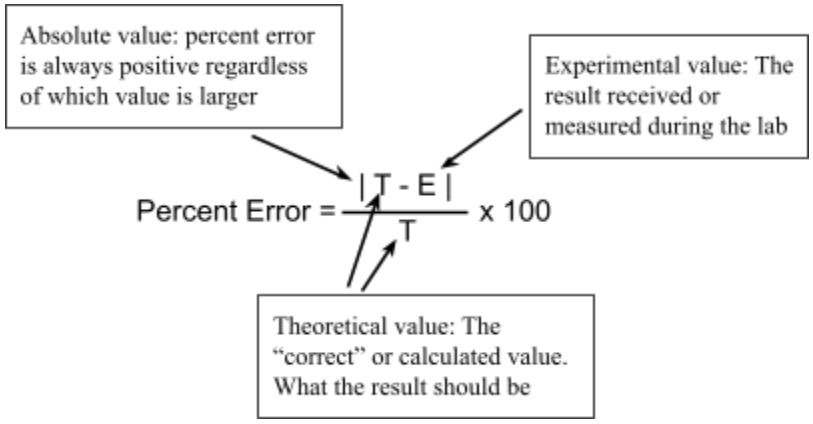
1. 8, 10, 15, 7, 9, 10, 10, 6, 8, 6, 5, 11, 9, 12, 10, 13

2. 755, 767, 744, 760, 744, 761, 739, 760, 754, 751, 755, 760, 755, 759, 760, 770, 760, 749

For each pair of variables, identify the Independent and Dependent variables.

3. _____ Temperature _____ Hours of heating
4. _____ Stopping Distance _____ Speed of car
5. _____ Number of people in family _____ Cost per week of groceries
6. _____ Stream flow rate _____ Amount of rainfall
7. _____ Tree age _____ Average height of the tree
8. _____ Test score _____ Number of hours studying
9. _____ Population of city _____ Number of schools needed

Percent error is a measure of accuracy for data by comparing the experimentally obtained value to the correct or accepted value.



Solve the following problems for percent error. Show your equation with all values plugged in before solving.

10. During a lab, you determine the density of aluminum to be 2.85 g/cm^3. If the textbook density of aluminum is 2.7 g/cm^3, what is your percent error?

11. After going through a chemical reaction, you measure the mass of your product to be 22.37 g. Your calculations show that the reaction should have produced 26.8 g of product. What is your percent error?

Use the data table to answer the following questions.

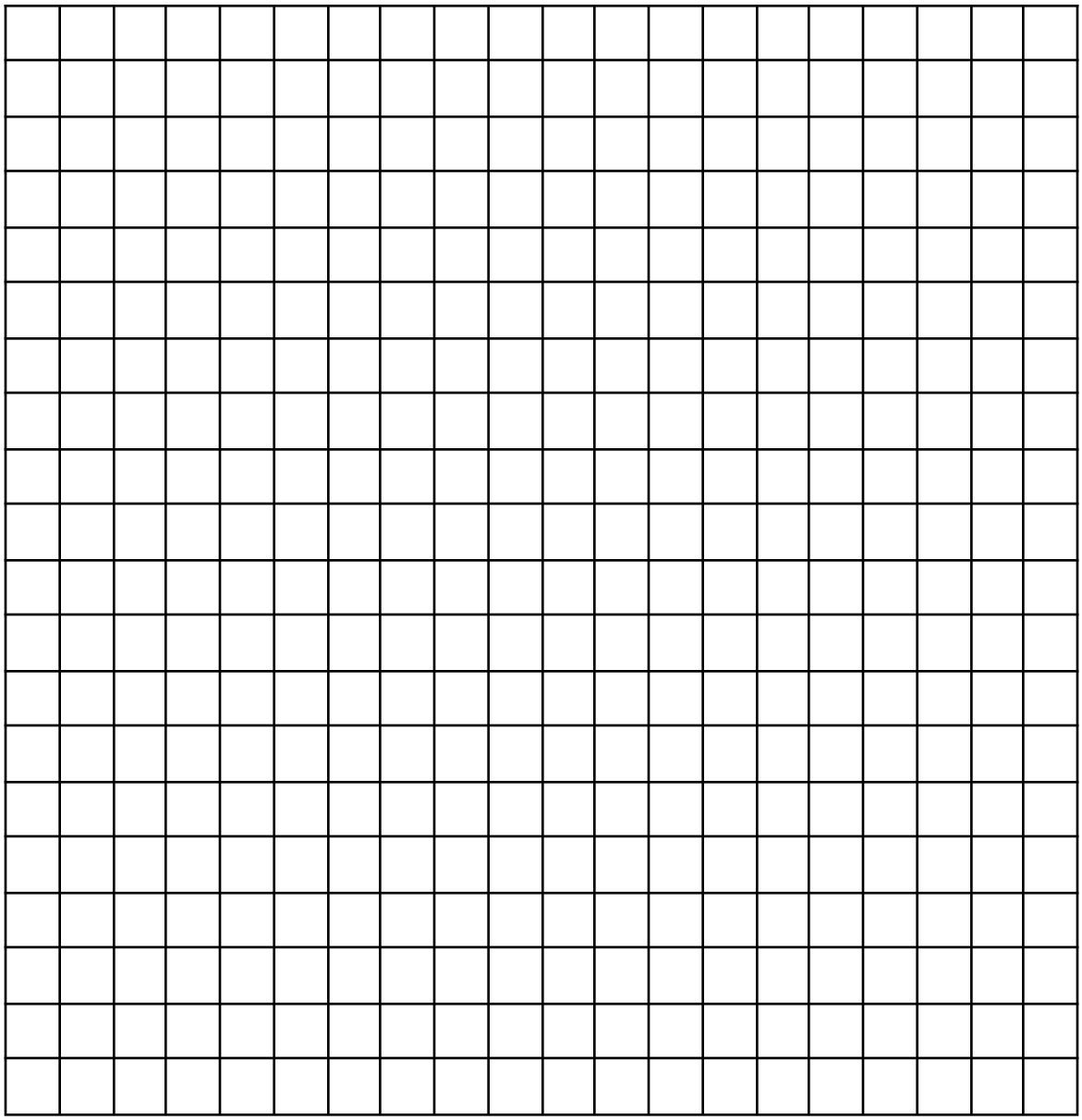
City	Average March Temperature (°F)	Latitude
Atlanta, GA	53	34
Boston, MA	38	42
Buffalo, NY	33	43
Dallas, TX	56	33
Houston, TX	61	30
Kansas City, MO	42	39
Lexington, KY	44	38
Los Angeles, CA	60	34
Miami, FL	72	26
Nashville, TN	49	36
Phoenix, AZ	82	33

12. On the following page, make a scatter plot of temperature versus latitude. Choose an appropriate scale for your data and make the graph large enough to see. Include all axis labels with units. Your scale does not have to start at 0.

13. Use a ruler to draw the best-fit line on your graph.

14. What type of relationship is shown by this graph? (Positive or Negative)

15. Are there any outliers in the data? _____
    If so, circle them and explain why that point may be an outlier.



Algebra Review

Solve the following problems for the variable. List **all** possible answers and round all answers to **3** significant digits. Use **DNE** if a **real** answer does not exist. You must show all your work.

1. $2x + 5 = 7$

2. $5x - 12 = 6 - x$

3. $32 = 13 - 6x$

4. $\frac{3x}{4} = 6$

5. $\frac{3}{x} = 5$

6. $\frac{18}{x} + 12 = 6$

7. $\frac{8x}{3} = \frac{9}{4}$

8. $\frac{11}{21x} = \frac{4}{13}$

9. $x^2 - 17 = 8$

10. $(5x - 4)(x + 1) = 0$

11. $2x^2 = 5x + 17$

Solve the following equations in terms of the given variable. Simplify as much as possible.

12. Solve for a: $ab + cd = e$

13. Solve for y: $\frac{xy}{z} = w$

14. Solve for p: $ft = \frac{g}{p^2} + s$

15. Solve for r: $w(r + y) = xr - t$

16. Solve for n: $an^2 = ng^2 + np$