MSI Summer Work

STEM

Science

Engineering

Mathematics

E=mc²
MSI ADVANCED CHEMISTRY

SUMMER ASSIGNMENT 2018-19

I am excited to teach you next year in MSI chemistry as I hope you are to be taking it with me. Chemistry is a subject where you will learn about the building blocks of the universe and how they combine and change to form everything around us. To be fully prepared for the rigorous and exciting course you will need to complete the summer assignment so that we may hit the ground running this year. It will be due by the end of the first week of school so that any remaining questions we can address the first few days of class. This will count as a test grade worth 100 points so let’s start the year off strong. Any late assignments will be graded based on the MISD’s late policy work. If you are having problems completing the packet do not wait until the last minute to ask for help. I have attached the information join the MSI Group on Remind to message me with any questions. My email to best reach me is knutke1001@gmail.com if you have issues with the other to methods listed above. Good luck with the summer homework and reach out if you need anything. I can’t wait to start this incredible journey ahead in MSI Chemistry.

Your summer assignment has multiple parts. Complete them all for full credit!

A. Element and Polyatomic Flashcards 10pts  
B. Atomic Structure Worksheet 10pts  
C. Scientific Method Worksheet 10pts  
D. Real World Examples 10pts  
E. Measurement – Metric System 10pts  
F. Significant Figures 10pts  
G. Scientific/Exponential Notation 10pts  
H. Solving for Variables 10pts  
I. Scientific Graphing 10pts  

Total 90pts

Chemistry is a difficult course for many students. This being an advanced course that means it is a fast paced course and rigorous, so it is important that students do their homework and get it in ON TIME! Use tutorial times and ask questions often and above all else try your best!!

A. Make flashcard to help you learn some of the elements and poly atomic ions that we will use throughout the year. We will have a quiz over these early in the year.

You will be responsible for learning the names and symbols for these elements. Note the chemical symbols for an element are composed of one or two letters. The first letter is always capitalized and the second if present is always lower case. Be sure to know the correct spelling of the elements as well.
Sign up for important updates from K. McKee.

Get information for Mabank High School right on your phone—not on handouts.

Pick a way to receive messages for MSI Chemistry 2018-19:

A. If you have a smartphone, get push notifications.

On your iPhone or Android phone, open your web browser and go to the following link:

[rmd.at/msichem19](rmd.at/msichem19)

Follow the instructions to sign up for Remind. You'll be prompted to download the mobile app.

B. If you don't have a smartphone, get text notifications.

Text the message @msichem19 to the number 81010.

If you're having trouble with 81010, try texting @msichem19 to (903) 525-6268.
* Standard text message rates apply.

Don't have a mobile phone? Go to [rmd.at/msichem19](rmd.at/msichem19) on a desktop computer to sign up for email notifications.
<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol</th>
<th>Name</th>
<th>Symbol</th>
<th>Name</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>H</td>
<td>Aluminum</td>
<td>Al</td>
<td>Manganese</td>
<td>Mn</td>
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<tr>
<td>Helium</td>
<td>He</td>
<td>Silicon</td>
<td>Si</td>
<td>Iron</td>
<td>Fe</td>
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<td>Lithium</td>
<td>Li</td>
<td>Phosphorus</td>
<td>P</td>
<td>Cobalt</td>
<td>Co</td>
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<tr>
<td>Beryllium</td>
<td>Be</td>
<td>Sulfur</td>
<td>S</td>
<td>Nickel</td>
<td>Ni</td>
</tr>
<tr>
<td>Boron</td>
<td>B</td>
<td>Chlorine</td>
<td>Cl</td>
<td>Copper</td>
<td>Cu</td>
</tr>
<tr>
<td>Carbon</td>
<td>C</td>
<td>Argon</td>
<td>Ar</td>
<td>Zinc</td>
<td>Zn</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>N</td>
<td>Potassium</td>
<td>K</td>
<td>Gallium</td>
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<td>O</td>
<td>Calcium</td>
<td>Ca</td>
<td>Germanium</td>
<td>Ge</td>
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<tr>
<td>Fluorine</td>
<td>F</td>
<td>Scandium</td>
<td>Sc</td>
<td>Arsenic</td>
<td>As</td>
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<tr>
<td>Neon</td>
<td>Ne</td>
<td>Titanium</td>
<td>Ti</td>
<td>Selenium</td>
<td>Se</td>
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<tr>
<td>Sodium</td>
<td>Na</td>
<td>Vanadium</td>
<td>V</td>
<td>Bromine</td>
<td>Br</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mg</td>
<td>Chromium</td>
<td>Cr</td>
<td>Krypton</td>
<td>K</td>
</tr>
</tbody>
</table>

**a. Polyatomic ions and names**

Write the element symbol on one side of your card and the ion name on the other. Spelling counts so be careful.

<table>
<thead>
<tr>
<th>Formula (charge)</th>
<th>Name</th>
<th>Formula (charge)</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{C}_2\text{H}_3\text{O}_2$ (-1)</td>
<td>Acetate</td>
<td>$\text{OH}$ (-1)</td>
<td>Hydroxide</td>
</tr>
<tr>
<td>$\text{NH}_4$ (+1)</td>
<td>Ammonium</td>
<td>$\text{ClO}$ (-1)</td>
<td>Hypochlorite</td>
</tr>
<tr>
<td>$\text{BO}_3$ (-3)</td>
<td>Borate</td>
<td>$\text{NO}_3$ (-1)</td>
<td>Nitrate</td>
</tr>
<tr>
<td>$\text{CO}_3$ (-1)</td>
<td>Carbonate</td>
<td>$\text{NO}_2$ (-1)</td>
<td>Nitrite</td>
</tr>
<tr>
<td>$\text{ClO}_3$ (-1)</td>
<td>Chlorate</td>
<td>$\text{ClO}_4$ (-1)</td>
<td>Perchlorate</td>
</tr>
<tr>
<td>$\text{Cr}_2\text{O}_7$ (-2)</td>
<td>Dichromate</td>
<td>$\text{MnO}_4$ (-1)</td>
<td>Permanganate</td>
</tr>
<tr>
<td>CN (-1)</td>
<td>Cyanide</td>
<td>$\text{PO}_4$ (-3)</td>
<td>Phosphate</td>
</tr>
<tr>
<td>CrO$_4$ (-2)</td>
<td>Chromate</td>
<td>$\text{PO}_3$ (-3)</td>
<td>Phosphite</td>
</tr>
<tr>
<td>HCO$_3$ (-1)</td>
<td>Hydrogen Carbonate</td>
<td>$\text{SO}_4$ (-2)</td>
<td>Sulfate</td>
</tr>
<tr>
<td>HSO$_4$ (-1)</td>
<td>Hydrogen Sulfate</td>
<td>$\text{SO}_3$ (-2)</td>
<td>Sulfite</td>
</tr>
</tbody>
</table>

On the following pages are practice problems you will see throughout the year. Use the study notes on the left hand side of most pages and your STAAR reference material to assist you. There is an extra piece of scratch paper for you to use. All scratch paper must be turned in with your packet.
**Periodic Table of the Elements**

**Reference Materials**

**STAR Chemistry**
<table>
<thead>
<tr>
<th>Metal</th>
<th>Common Exceptions</th>
<th>Soluble Compounds Contain</th>
<th>Insoluble Compounds Contain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>C₂⁻,  S⁻²,  and  B₁⁻</td>
<td>S⁻²,  SO₄²⁻</td>
<td>S⁻²,  SO₄²⁻</td>
</tr>
<tr>
<td>Platinum</td>
<td>Compounds of N₇⁺</td>
<td>OH⁻,  PO₄³⁻</td>
<td>Si³⁻,  SiO₄³⁻</td>
</tr>
<tr>
<td>Silver</td>
<td>Compounds of N₇⁺</td>
<td>C₃²⁻,  CrO₄²⁻</td>
<td>P₃⁻,  P₂O₅⁻</td>
</tr>
<tr>
<td>Mercury</td>
<td>Compounds of N₇⁺</td>
<td>C₄²⁻,  Cr₂O₇⁻</td>
<td>Cl⁻,  CrO₂⁻</td>
</tr>
<tr>
<td>Copper</td>
<td>Compounds of N₇⁺</td>
<td>C₅²⁻,  Cr₃O₇⁻</td>
<td>F⁻,  Cr₂O₇⁻</td>
</tr>
<tr>
<td>(Hydrogen)</td>
<td>Compounds of N₇⁺</td>
<td>C₆²⁻,  Cr₃O₇⁻</td>
<td>F⁻,  Cr₂O₇⁻</td>
</tr>
<tr>
<td>Lead</td>
<td>Compounds of N₇⁺</td>
<td>C₇²⁻,  Cr₃O₇⁻</td>
<td>F⁻,  Cr₂O₇⁻</td>
</tr>
<tr>
<td>Tin</td>
<td>Compounds of N₇⁺</td>
<td>C₈²⁻,  Cr₃O₇⁻</td>
<td>F⁻,  Cr₂O₇⁻</td>
</tr>
<tr>
<td>Nickel</td>
<td>Compounds of N₇⁺</td>
<td>C₉²⁻,  Cr₃O₇⁻</td>
<td>F⁻,  Cr₂O₇⁻</td>
</tr>
<tr>
<td>Cobalt</td>
<td>Compounds of N₇⁺</td>
<td>C₁₀⁻,  Cr₂O₇⁻</td>
<td>F⁻,  Cr₂O₇⁻</td>
</tr>
<tr>
<td>Iron</td>
<td>Compounds of S²⁻,  Ba²⁺,  Pb²⁺,  and  Hg²⁺</td>
<td>Ba²⁺,  Pb²⁺,  and  Hg²⁺</td>
<td>Ba²⁺,  Pb²⁺,  and  Hg²⁺</td>
</tr>
<tr>
<td>Chromium</td>
<td>Compounds of A⁹⁺,  Ag⁺,  and  Hg²⁺</td>
<td>Ag⁺,  and  Hg²⁺</td>
<td>Ag⁺,  and  Hg²⁺</td>
</tr>
<tr>
<td>Zinc</td>
<td>Compounds of A⁹⁺,  Ag⁺,  and  Hg²⁺</td>
<td>Ag⁺,  and  Hg²⁺</td>
<td>Ag⁺,  and  Hg²⁺</td>
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<tr>
<td>Manganese</td>
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<tr>
<td>Aluminum</td>
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<td>None</td>
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<td>Magnesium</td>
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</tr>
<tr>
<td>Sodium</td>
<td>None</td>
<td>None</td>
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</tr>
<tr>
<td>Calcium</td>
<td>None</td>
<td>None</td>
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</tr>
<tr>
<td>Barium</td>
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<td>None</td>
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</tr>
<tr>
<td>Potassium</td>
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<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Rubidium</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Lithium</td>
<td>None</td>
<td>None</td>
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</tbody>
</table>

**Reference Materials**

**STAR Chemistry**

**IONs**

**Polyatomic**

**IIonic Compounds in Water**

**Activity Series**

**Solubility of Common**
OTHER FORMULAS

Density \(D\) = \(\frac{\text{mass}}{\text{volume}}\)

Percent error = \(\left(\frac{\text{accepted value} - \text{experimental value}}{\text{accepted value}}\right) \times 100\)

Percent yield = \(\left(\frac{\text{actual yield}}{\text{theoretical yield}}\right) \times 100\)

CONSTANTS AND CONVERSIONS

Avogadro's number = 6.02 \times 10^{23} \text{ particles per mole}

\(h = \text{Planck's constant} = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}\)

\(c = \text{speed of light} = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}\)

\(K_w = \text{ionization constant of water} = 1.00 \times 10^{-14} \left(\frac{\text{mol}}{\text{L}}\right)^2\)

alpha particle (α) = \(\frac{4}{2}\text{He}\)  beta particle (β) = \(\frac{0}{-1}\text{e}\)  neutron = \(\frac{1}{0}\text{n}\)

standard temperature and pressure (STP) = 0°C and 1 atm

0°C = 273 K

volume of ideal gas at STP = 22.4 \(\frac{\text{L}}{\text{mol}}\)

1 cm\(^3\) = 1 mL = 1 cc

1 atm = 760 mm Hg = 101.3 kPa

\(R = \text{ideal gas constant} = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = 8.31 \frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}} = 62.4 \frac{\text{L} \cdot \text{mm Hg}}{\text{mol} \cdot \text{K}}\)

1 calorie (cal) = 4.18 joules (J)

1000 calories (cal) = 1 Calorie (Cal) = 1 kilocalorie (kcal)

RULES FOR SIGNIFICANT FIGURES

1. Non-zero digits and zeros between non-zero digits are always significant.
2. Leading zeros are not significant.
3. Zeros to the right of all non-zero digits are only significant if a decimal point is shown.
4. For values written in scientific notation, the digits in the coefficient are significant.
5. In a common logarithm, there are as many digits after the decimal point as there are significant figures in the original number.
**ATOMIC STRUCTURE**

Speed of light = (frequency)(wavelength) \[ c = f \lambda \]

Energy = (Planck's constant)(frequency) \[ E_{\text{photon}} = hf \]

Energy = \( \frac{(\text{Planck's constant})(\text{speed of light})}{(\text{wavelength})} \) \[ E_{\text{photon}} = \frac{hc}{\lambda} \]

**BEHAVIOR OF GASES**

Total pressure of a gas = \( \left( \frac{\text{sum of the partial pressures of the component gases}}{\text{of the component gases}} \right) \) \[ P_T = P_1 + P_2 + P_3 + \ldots \]

(Pressure)(volume) = (moles)(ideal gas constant)(temperature) \[ PV = nRT \]

\( \frac{(\text{initial pressure})(\text{initial volume})}{(\text{initial moles})(\text{initial temperature})} = \frac{(\text{final pressure})(\text{final volume})}{(\text{final moles})(\text{final temperature})} \)

\[ \frac{PV_1}{n_1T_1} = \frac{PV_2}{n_2T_2} \]

\( \text{(initial pressure)}(\text{initial volume}) = \text{(final pressure)}(\text{final volume}) \)

\[ PV_1 = PV_2 \]

\( \frac{\text{(initial volume)}}{\text{(initial temperature)}} = \frac{\text{(final volume)}}{\text{(final temperature)}} \)

\[ \frac{V_1}{T_1} = \frac{V_2}{T_2} \]

\( \frac{\text{(initial volume)}}{\text{(initial moles)}} = \frac{\text{(final volume)}}{\text{(final moles)}} \)

\[ \frac{V_1}{n_1} = \frac{V_2}{n_2} \]

**SOLUTIONS**

Molarity = \( \frac{\text{moles of solute}}{\text{liter of solution}} \)

\[ M = \frac{\text{mol}}{\text{L}} \]

Ionization constant of water = \( \left( \frac{\text{hydrogen ion concentration}}{\text{hydroxide ion concentration}} \right) \)

\[ K_w = [H^+][OH^-] \]

\( \frac{\text{volume of solution 1}}{\text{molarity of solution 1}} = \frac{\text{volume of solution 2}}{\text{molarity of solution 2}} \)

\[ V_1M_1 = V_2M_2 \]

\( \text{pH} = -\log[H^+] \)

**THERMOCHEMISTRY**

Heat gained or lost = (mass)(specific heat)(change in temperature) \[ Q = mc \Delta T \]

Enthalpy of reaction = (enthalpy of products) - (enthalpy of reactants) \[ \Delta H = \Delta H_f^0(\text{products}) - \Delta H_f^0(\text{reactants}) \]
B)  
Atomic Structure Worksheet

1. Name the three particles of the atom and their respective charges:
   a. __________________________  __________________________
   b. __________________________  __________________________
   c. __________________________  __________________________

2. The number of protons in one atom of an element determines the atom’s______ , and the number of electrons determines________________________ of an element.

3. 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 elements will have the_______ atomic number.

4. The________________________of an element is the average mass of an element’s naturally occurring atoms, or isotopes, taking into account the________________________ of each isotope.

5. The________________________of an element is the total number of protons and neutrons in the ____ _______ of the atom.

6. 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 ____________ _______.

7. Give the symbol and number of protons in one atom of:
   - Lithium __________________________
   - Bromine __________________________
   - Iron __________________________
   - Copper __________________________
   - Oxygen __________________________
   - Mercury __________________________
   - Arsenic __________________________
   - Helium __________________________
8. Give the symbol and number of electrons in a neutral atom of:
   Uranium ___________________________  Chlorine ___________________________
   Boron ___________________________  Iodine ___________________________
   Antimony ___________________________  Argon ___________________________

9. An isotope is the same element with a different mass. It is not unlike a room full of people with different weights. When writing the symbol for an isotope the element symbol is written with the mass at the top and the atomic number at the bottom. Example $^{30}_{12}\text{Mg}$

   Give the isotope symbol and number of neutrons in one atom of the following elements. Show your calculations.
   
   Barium – 138 ___________________________  Sulfur – 32 ___________________________
   Carbon – 12 ___________________________  Hydrogen – 1 ___________________________
   Fluorine – 19 ___________________________  Magnesium – 24 ___________________________
   Silicon – 28 ___________________________  Mercury – 202 ___________________________

10. Name the element which has the following numbers of particles. Be specific. (Include charges and mass numbers where possible.)

   26 electrons, 29 neutrons, 26 protons ___________________________
   53 protons, 74 neutrons ___________________________
   2 electrons (neutral atom) ___________________________
   20 protons ___________________________
   86 electrons, 125 neutrons, 82 protons (charged atom) ___________________________
   0 neutrons ___________________________

11. If you know ONLY the following information can you always determine what the element is? (Yes/No).
   number of protons ____________
   number of neutrons ____________
   number of electrons in a neutral atom ____________
   number of electrons ____________
C) Scientific Method Review

Directions: Complete the following problems using resources (Ex. Computer) for help. These are topics that will be on the test and it is important that you answer them correctly and study this often!

1. Define the Scientific Method:

2. Put the steps of the Scientific Method in the correct order:
   Some resources will give you anywhere from 5-7 steps. Either is fine as long as they are in order.
   
   1.
   2.
   3.
   4.
   5.
   6.
   7.

4. Define Hypothesis: ___________________________________________________________

5. An independent variable is the thing that __________________________________________

6. A dependent variable is the thing that ____________________________________________

7. A controlled variable is the thing that ____________________________________________

8. Underline the independent variable, and circle the dependent variable:
   a. If Mr. Hasson takes a vitamin pill every day, then he won't get sick for an entire year.
   b. If Mrs. Piper waters her garden two times a day, then all of the plants will grow three inches in two weeks.
   c. If Mr. Monahan runs three miles every morning, then he will lose seven pounds in a month.
9. An experiment is ____________________________________________

10. How many things should be changed during an experiment? _____________________

11. How can a scientist make sure that the results of an experiment are not a mistake?

12. Name three tools that can be used to collect data:
   a. ______________________
   b. ______________________
   c. ______________________

13. Name two things that should be used to analyze data:
   a. ______________________
   b. ______________________

14. To make a conclusion, you should compare your ________ to your ________
   a. What happens if they match? ____________________________________________
   b. What should you do if they do not match? ________________________________

15. Define Observation: _________________________________________________
   a. A ______________________ observation is when you describe something.
   b. A ______________________ observation is when you count something.
16. Write “QL” for Qualitative and “QT” for Quantitative
   
   a. _______ The sky is blue.
   b. _______ There are 13 clouds in the sky.
   c. _______ Mr. Hasson’s tie is smooth.
   d. _______ The guinea pig smells bad.
   e. _______ There are 20 students in the class.

17. An ________________ is your best guess as to what caused the thing that you observed.

18. Write “I” for Inference or “O” for Observation
   
   a. _______ When I rang the doorbell, no one answered.
   b. _______ The hamburger was hot.
   c. _______ Jamal must be very popular.
   d. _______ The sun set at 7:18 pm.
   e. _______ That sounded like a mean dog.
For each topic in the space provided to the right, determine a real world example and how that topic relates to your every day life.

<table>
<thead>
<tr>
<th>Topics Covered</th>
<th>Real World Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement &amp; Metric System</td>
<td></td>
</tr>
<tr>
<td>Classification of Matter</td>
<td></td>
</tr>
<tr>
<td>States and Changes in Matter</td>
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<tr>
<td>Thermochemistry - Energy</td>
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<tr>
<td>Atomic Structure</td>
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<td>Nuclear Chemistry – Nucleus</td>
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<td>Electrons</td>
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<td>Chemical Bonding</td>
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<td>Organic Chemistry</td>
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<td>Chemical Reactions</td>
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<td>Stoichiometry</td>
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<td>Gas Laws</td>
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<td>Aqueous Solutions</td>
<td></td>
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<tr>
<td>Acids/Bases/Salts</td>
<td></td>
</tr>
</tbody>
</table>
E) Measurement, the metric system and conversions

Directions: Read the information on the left side of the page, and then use it to answer the questions on the right side of the page.

In science, it is very important to make measurements to describe the observations that you make. Quantitative observations help us make use of our observations by making sense out of the patterns that we see. It is also very important to have a common system of measurement for the collaboration of people from around the world.

The metric system is an internationally agreed decimal system of measurement that was originally based on the mètre des archives and the kilogramme des archives introduced by France in 1799. Over the years, the definitions of the meter and kilogram have been refined and the metric system has been extended to incorporate many more units. Although a number of variants of the metric system emerged in the late nineteenth and early twentieth centuries, the term is now often used as a synonym for “SI” or the “International System of Units”—the official system of measurement in almost every country in the world.

The variation of the metric system we use is the “MKS” which stands for Meter, Kilogram and Second
- m; the meter for length
- kg; the kilogram for mass
- s; the second for time

along with;
- A; the ampere for electric current
- K; the Kelvin for temperature
- mol; the mole for amount of substance
- cd; the candela for luminous intensity

Unfortunately, the United States is one of the few countries in the world that do not use the metric system. This means that you must be able to make conversions from the English system to the SI system.

Common English to metric conversion factors.
- 1 ft (foot) = 0.305 m
- 1 mi (mile) = 1.61 km (kilometers)
- 1 lb (pound) = 0.45 kg
- Degrees Celsius (°C) = (°F - 32) x 5/9
- Kelvins (K) = °C + 273
- 1 gallon (gal) = 4.55 L (liter)
- 1 L = 1000 mL = 1000 cc (cubic centimeters)

1) What unit would be used to measure each of the following:
   a) The distance from your home to school:
   b) How much you gained after eating thanksgiving dinner:
   c) Describing how long it would take you to get ready in the morning:
   d) Describing how hot or cold it is on a warm summer day:
   e) Explaining how many molecules there are in a gallon of gasoline:

2) Using the conversion table/facts, convert the following measurements;
   a) 6 foot tall person in meters.

\[
\frac{6 \text{ ft}}{1} \times \left( \frac{0.305 \text{ m}}{1 \text{ ft}} \right) = 1.83 \text{ meters}
\]

   b) A 26.2 mile marathon in kilometers.
   c) Your weight in pounds in kilograms.
   d) A 20 gallon gas tank in liters.
   e) A warm summer day (90°F) in Kelvins.
   f) 55 miles per hour in kilometers per hour
F) Significant digits/figures & rounding

Directions: Read the information on the left side of the page, and then use it to answer the questions on the right side of the page.

Significant digits/figures are the digits in any measurement that are known with certainty, plus one digit that is uncertain. These digits are based on the precision of the measuring instrument used.

Rule 1: In numbers that do not contain zeros, all the digits are significant.
- 3.1428 [5]
- 3.14 [3]
- 469 [3]

Rule 2: All zeros between significant digits are significant.
- 7.053 [4]
- 7053 [4]
- 302 [3]

Rule 3: Zeros to the left of the first nonzero digit serve only to fix the position of the decimal point and are not significant.
- 0.0056 [2]
- 0.0789 [3]
- 0.000001 [1]

Rule 4: In a number with digits to the right of a decimal point, zeros to the right of the last nonzero digit are significant.
- 43 [2]
- 43.0 [3]
- 43.00 [4]
- 0.00200 [3]
- 0.00050 [5]

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.
- 3.6 x 10^3 contains two significant digits

1) How many significant digits are in each of the following measurements? In second column, make some up of your own.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Sig. fig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>26.2 mi</td>
<td></td>
</tr>
<tr>
<td>105 °F</td>
<td></td>
</tr>
<tr>
<td>0.00538 m</td>
<td></td>
</tr>
<tr>
<td>1.00 kg</td>
<td></td>
</tr>
<tr>
<td>5.65 x 10^7 nm</td>
<td></td>
</tr>
<tr>
<td>6.02 x</td>
<td></td>
</tr>
<tr>
<td>10^{23} atoms</td>
<td></td>
</tr>
</tbody>
</table>

2) Round the number π (3.14159265359) to:
   a) 1 sig. fig. =
   b) 2 sig. fig. =
   c) 3 sig. fig. =
   d) 4 sig. fig. =
   e) 5 sig. fig. =
   f) 6 sig. fig. =

SIGNIFICANT DIGITS IN OPERATIONS

3) Add or subtract as indicated and state the answer with the correct number of significant digits. (Your answer will have the same number of significant digits to the right of the decimal as the number with the least amount of digits to the right of the decimal.)
   a) 85.26 cm + 4.6 cm
   b) 1.07 m + 0.607 m
   c) 186.4 g - 57.83 g
   d) 60.08 s - 12.2 s
   e) 4,285.75 - 520.1 - 386.255
   f) 72.60 m + 0.0950 m

4) Multiply or divide as indicated and state the answer with the correct number of significant digits. (Your answer will have the same number of significant digits as the number with the least amount of digits.)
   a) (5.5 m) (4.22 m) = (calc. says 23.210) = 23
   b) (0.0167 km) (8.525 km)
   c) 2.6 kg ÷ 9.42 m³
   d) 0.632 m ÷ 3.8 s
   e) (8.95) (9.162)/(4.25) (6.3)
   f) 0.0045 mm² ÷ 0.90 mm

http://mistersuch.brinkster.net/siffigs.html
G) Scientific/exponential notation

Directions: Read the information on the left side of the page, and then use it to answer the questions on the right side of the page.

Scientific notation is a way of writing numbers that are too big or too small to be conveniently written in decimal form. Scientific notation has a number of useful properties and is commonly used in calculators and by scientists, mathematicians and engineers.

In scientific notation all numbers are written in the form of \( a \times 10^b \) (a times ten raised to the power of b), where the exponent “b” is an integer, and the coefficient “a” is any real number. Correct scientific notation has only one number to the left of the decimal and retains the proper number of significant figures.

<table>
<thead>
<tr>
<th>Standard decimal notation</th>
<th>Normalized scientific notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>( 2.0 \times 10^0 )</td>
</tr>
<tr>
<td>0.2</td>
<td>( 2 \times 10^{-1} )</td>
</tr>
<tr>
<td>300</td>
<td>( 3 \times 10^2 )</td>
</tr>
<tr>
<td>6,720,000,000</td>
<td>( 6.72 \times 10^9 )</td>
</tr>
<tr>
<td>0.000 000 007 51</td>
<td>( 7.51 \times 10^{-9} )</td>
</tr>
</tbody>
</table>

2) Using the metric prefixes, name the following numbers;

a) \( 6.02 \times 10^{23} \)

b) 1000

c) 0.036

d) \( 2.36 \times 10^{-6} \)

3) Using the metric prefixes, change the following numbers appropriately

a) 450 mL into L

b) 2.8 L into mL

c) 26 cm into mm

d) \( 2.3 \times 10^7 \) nm into mm
Equations/Solving for variables
Directions: Read the information on the left side of the page, and then use it to answer the questions on the right side of the page.

Many relationships in chemistry can be expressed as simple algebraic equations. However, the equation given is not always in the form that is most useful in figuring out a particular problem. In such a case, you must first solve the equation for the unknown quantity; this is done by rearranging the equation so that the unknown is on one side of the equation, and all the known quantities are on the other side.

An equation is solved using the laws of equality. The laws of equality are summarized as follows: if equals are added to, subtracted from, multiplied by, or divided by equals, the results are equal. In other words, you can perform any of these mathematical operations on an equation and not destroy the equality, as long as you do the same thing to both sides of the equation. The laws of equality apply to any legitimate mathematical operation, including squaring, taking square roots, and taking the logarithm.

Consider the following equation relating the Kelvin and Celsius temperature scales.

\[ K = ^\circ C + 273 \]

If we need to solve this equation for °C we need to get °C by itself on one side of the equation. This means we need to move 273 to the other side. To do this we need to do the opposite of the operation that is attaching °C and 273, the opposite of addition is subtraction. So we need to subtract both sides by 273.

\[ K - 273 = ^\circ C + 273 - 273 \]

The 273 will cancel on the right side of the equation.

\[ K - 273 = ^\circ C + 273 - 273 \]

Leaving:

\[ K - 273 = ^\circ C \]

If they were attached by subtraction you would need to use addition to separate them.

The same thing goes for if the numbers are attached by multiplication.

\[ ^\circ F = (1.8 \times ^\circ C) + 32 \]

You would need to subtract both sides by 32 and then divide both sides by 1.8.

\[ \frac{^\circ F - 32}{1.8} = ^\circ C \]

There is one slight change for division, you need to first move your unknown to the numerator if it is in denominator.

1) Solve the following for x:
   a) 14x + 12 = 40
   b) \( \frac{5}{x} + 8 = 11 \)
   c) kx = a + by
   d) 2y - 2x = 38
   e) 5x - 2 = 8

2) Solve the following for x1:
   a) 3x1 + 5y1 = 2x2 + 8y2
   b) y1x1 - k2x2 = 0

3) Solve the following equation PV = nRT
   a) For P:
   b) For V:
   c) For n:
   d) For R:
   e) For T:
Scientific Graphing

Most scientific graphs are made as line graphs. There may be times when other types would be appropriate, but they are rare.

The lines on scientific graphs are usually drawn either straight or curved. These "smoothed" lines do not have to touch all the data points, but they should at least get close to most of them. They are called best-fit lines.

In general, scientific graphs are not drawn in connect-the-dot fashion.

Title, Axis, Interval, Line, Slope statement or TAILS for short.

Title
The title should represent what is being tested. A small statement consisting of both variables.

Axis
Axis should always be labeled with the manipulated (independent) variable on the X-axis and the responding (dependent) variable on the Y-axis.

Interval
Your graph should take up as much of the graph as possible. The scale should use intervals such as 1, 2, 5, 10 units per block.

Line of best fit
NEVER connect the dots on a scientific graph. Use a ruler to draw a straight line through your data. If the data looks as if it represents a curve, freehand draw a curved line through your data.

Slope
In the form of \( y = mx + b \) where "b" is the y-axis intercept

A good graph

![Graph of Traffic Ticket Cost on Automobile Speed](image)

Graph 1: Temperature scales

Use the following data to draw a graph that shows the relationship between the Fahrenheit and Celsius temperature scales.

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>32</th>
<th>68</th>
<th>98.6</th>
<th>212</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp (°C)</td>
<td>-40</td>
<td>0</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

Graph 2: Gas Laws

The following data shows the conditions a diver experiences as they travel to depths in increments of 10m. This is a representation of one of the gas laws which can be useful to drivers. Use the following data to draw a graph that shows the relationship between the Pressure (units of atm) and Volume (units of L).

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Pressure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1000.0</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>500.0</td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>333.3</td>
</tr>
<tr>
<td>30</td>
<td>4</td>
<td>250.0</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>200.0</td>
</tr>
<tr>
<td>50</td>
<td>6</td>
<td>166.7</td>
</tr>
<tr>
<td>60</td>
<td>7</td>
<td>142.9</td>
</tr>
<tr>
<td>70</td>
<td>8</td>
<td>125.0</td>
</tr>
<tr>
<td>80</td>
<td>9</td>
<td>111.1</td>
</tr>
<tr>
<td>90</td>
<td>10</td>
<td>100.0</td>
</tr>
<tr>
<td>100</td>
<td>11</td>
<td>90.9</td>
</tr>
</tbody>
</table>

Website:
http://misterguch.brinkster.net/graph.html
Graph 1: Temperature Scales

Graph 2: Gas law
Welcome to Advanced Geometry!

This assignment should serve as a review of essential concepts needed to be successful in Advanced Geometry. It also contains some fundamental Geometry skills and vocabulary you should be familiar with as you enter the classroom next fall. If you need any assistance throughout your practice, please feel free to email me at nlhawkin@mabankisd.net. An additional helpful resource is the video based website www.khanacademy.org

3sfk6tf

If you have internet access, please join our Google Classroom using the class code V. We will be able to correspond easily throughout the summer using our online classroom. If you are unable to join the class this summer, to not worry, we will get set up the first few weeks of school.

Format of the Summer Assignment

Please turn in a cover page with your name, course name, and date.

Show all steps for each section.

Due Date

The summer assignment will be due by Monday August 20th
1. **Algebra Review: The Coordinate Plane**

Use this graph to answer the following questions.

Name the coordinates of each point.

1. M  
2. N  
3. K  
4. R  
5. S  
6. T  
7. U  
8. V  
9. W  
10. Q

11. Name all the points shown that lie on the x-axis.
12. Name all the points shown on the y-axis.
13. What is the x-coordinate of every point that lies on a vertical line through P?
14. Identify which of the following point(s) lie on a horizontal line through W?
   (-2, 1), (2, 3), (1, -3), (-2, 0), (0, -3), (2, 0)
15. Name the two points that both have a y-coordinate value of 3.

For each of the conditions below, create a point on the graph. Name that point with a capital printed letter and write the ordered pair representing its location.

16. \( x < 3 \)
    \( y \geq 0 \)
17. \( x > -4 \)
    \( y < -7 \)
18. \( x \leq 1 \)
    \( y \geq 5 \)
19. \( x \geq -3 \)
    \( y < 6 \)
2. Algebra Review: Solving Linear Equations and Inequalities

EXAMPLE:

\[3p + 2(p + 1) = 12\]
\[3p + 2p + 2 = 12\]
\[5p + 2 = 12\]
\[5p = 10\]
\[p = 2\]

\[2x - 7x + 20 < 40\]
\[-5x + 20 < 40\]
\[-5x < 20\]
\[x > -4\]

Solve each equation or inequality. Show all steps. Simplify and leave answers as fractions.

**Linear Equations**

1. \[2p + 5 = 13\]
2. \[12 + 2b = 2 + 5b\]
3. \[4x + 5 + 5x + 40 = 180\]
4. \[2(4x + 4) = x + 1\]
5. \[2(x + 5) = 3(x - 2)\]

**Linear Inequalities**

6. \[180 - x \leq 3(90 - x)\]
7. \[180 - y > 2(90 - y)\]
8. \[6x - 3(6 - 5x) \geq -4(2 - x)\]
9. \[10 - \frac{1}{4}(8x - 12) < \frac{1}{2}(2x - 4)\]
10. \[-(3x - 1) + 7 > 3(x - 5) + 4\]
3. Algebra Review: Solving Literal Equations

Example: Given the perimeter of a rectangle, solve for w.

\[ P = 2l + 2w \]
\[ P - 2l = 2w \]
\[ \frac{P - 2l}{2} = w \]

Solve each equation for the given variable.

1. Perimeter of rectangle: \( P = 2w + 2l \). Solve for \( l \).
2. Volume of prism: \( V = lwh \). Solve for \( w \).
3. Surface area of sphere: \( S = 4\pi r^2 \). Solve for \( r \).
4. Lateral area of cylinder: \( A = 2\pi rh \). Solve for \( r \).
5. Area of regular polygon: \( A = \frac{1}{2} ar \). Solve for \( a \).
6. Volume of cylinder: \( V = \pi r^2 h \). Solve for \( h \).
7. Area of triangle: \( A = \frac{1}{2}bh \). Solve for \( h \).
8. Circumference of circle: \( C = 2\pi r \). Solve for \( r \).
9. Volume of cone: \( V = \frac{1}{3}\pi r^2 h \). Solve for \( r \).
10. Area of trapezoid: \( A = \frac{1}{2} (b_1 + b_2)h \) Solve for \( b_1 \).

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4. **Algebra Review: Quadratic Equations**

**Factor each expression completely into two binomials:**
1. \( x^2 - 9 \)
2. \( x^2 + 6x + 9 \)
3. \( x^2 - 5x + 6 \)

**Factor out the GCF:**
4. \( 21x - 49 \)
5. \( 5x^2 + 25x \)
6. \( 6x^4 + 8x^3 + 12x^2 \)

**Simplify the following expressions:**
7. \( (x + 5)(x + 3) \)
8. \( (x - 7)(2x + 1) \)
9. \( (x - 9)(3x - 1) \)

**Solve using the Quadratic Formula:**
The Quadratic Formula uses the "a", "b", and "c" from \( ax^2 + bx + c = 0 \),
where "a", "b", and "c" are just numbers; they are the "numerical coefficients". The Formula is derived from the process of completing the square, and is formally stated as:

For \( ax^2 + bx + c = 0 \), the value of \( x \) is given by:

\[
\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

Leave your answers in simplest radical form.

10. \( 2x^2 - 3x - 1 = 0 \)
11. \( 3x^2 - 5x + 1 = 0 \)
12. \( 2x^2 - 3x - 15 = 5 \)
5. Algebra Review: Graphing

Graph each system of linear equations on the graph provided.

1. \[ y = 1 - 2x \]
   \[ y = -5 + 4x \]

2. \[ y = 2x + 7 \]
   \[ x = -3 \]

3. \[ 2x + 3y = 3 \]
   \[ -1 + y = 1/4x \]

4. \[ y = 5x - 4 \]
   \[ -10x + 2y = 6 \]

Use the slope formula to find the slope of the line containing each set of points. Find the y-intercept of each and write the equation of each line in slope intercept form.

5. \( (3, 6), (-6, 0) \)

6. \( (-7, 2), (-1, -4) \)

7. \( (5, 1), (5, 4) \)
6. Algebra Review: Radical Expressions

Simplifying Radicals - Radicals are in the simplest form when there are no perfect square factors inside the radical. You cannot have a radical in the denominator or a fraction inside the radical.

Simplify the following completely using perfect squares or factor trees. Do NOT use a calculator to find the decimal approximations for these square roots. Show all work.

1) \( \sqrt{36} \)
2) \( \sqrt{27} \)
3) \( \sqrt{400} \)
4) \( \sqrt{80} \)
5) \( -\sqrt{9} \)
6) \( \sqrt{\frac{64}{25}} \)

Use Pythagorean Theorem to find the missing side. Leave answers in the simplest radical form. Do NOT give answers in decimal form.

7) \[
\begin{array}{c}
15 \\
13
\end{array}
\]

8) \[
\begin{array}{c}
4 \\
7
\end{array}
\]

9) \[
\begin{array}{c}
20 \\
11
\end{array}
\]

10) \[
\begin{array}{c}
8 \\
12
\end{array}
\]
7. Geometry Review: Basic Figures

For each geometric solid below, identify the following: name of solid, number of vertices, number of edges, number of faces, number of bases, and the shape of the base.

1) 

2) 

3) 

4) 

5) 

6) 

7) 

8)
8. Internet components

Watch the video "Mathematics - Investigating Geometry I: Geometry Around the World" (the link below) and answer the questions below using complete sentences.

Source: http://www.youtube.com/watch?v=Dd057cF5Vms

1. What is the meaning of the word geometry?

2. What was measured with the earliest use of geometry?

3. What Egyptian monuments still stand today after 4,000 years and are considered as "masterpieces of straight-line geometry?" What geometric shape lead them to develop the calculations needed to create the monuments?

4. Identify the 3 most common types of geometry taught in schools today.

5. How many books did Euclid write and what were they called?

6. What two things did Euclid focus on using to make mathematical statements?

7. What do mathematicians call statements that have been proven to be true?

8. What is another name for coordinate geometry and who was it named after?

9. Identify the three types of transformations demonstrated in the video. Also, determine what a possible fourth transformation could be such that it would create similar figures instead of congruent figures like the three already named types.

10. Define the word conjecture.